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# The Role of Safety First Risk Preferences in Grain Marketing: A Laboratory Economic Experiment using a Grain Marketing Simulation Game

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# The Role of Safety First Risk Preferences in Grain Marketing: A Laboratory Economic Experiment using a Grain Marketing Simulation Game

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**The Role of Safety First Risk Preferences in Grain Marketing:**
**A Laboratory Economic Experiment**
**Using a Grain Marketing Simulation Game'**

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In this study, the Marketing in a New Era (MINE) grain marketing simulation game is used to carry out a context-rich economic experiment to evaluate the role of risk preferences in grain marketing decisions. The model of risk preferences that we consider is an improved Safety First decision rule model proposed by Levy and Levy (2009). We experimentally test if Safety First decision rule describes individuals' post-harvest marketing decisions. In our experiment, we incorporate real-world features which are usually omitted in marketing studies such as: multiple storage decisions, storage cost, actual price series and multiple contract frequency. MINE plays a critical role by allowing us to observe participant's intra-season hedging decisions. Our results indicate that Safety First matters in post-harvest marketing decisions. Specifically, individuals with strong Safety First preferences sell significantly more grain at the spot market right after harvest compared to individuals without strong Safety First preferences. This research may be of interest to those working on marketing advisory services, in developing guidelines for optimal marketing strategies that apart from market and farm characteristics should consider personal characteristics as well.

## Author's Acknowledgments

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# CHAPTER 1

## A UNIQUE MARKETING EDUCATIONAL TOOL: MARKETING IN A NEW ERA SIMULATION GAME

# 1. Introduction

Every year many extension meetings across the U.S. focus on grain marketing risk management. Grain marketing represents an important challenge that producers face since the commodity price received directly impacts revenue and therefore profit. Producers face the threat of weak farm income and possible farm failure due to production and commodity price risk, reminding them that room for mistakes is limited (Musser, Patrick and Eckman, 1996). To improve commodity price risk, grain marketing education is needed. However, in an educational setting it is quite challenging to make economic concepts interesting and rigorous enough for audiences to leave with improved skills. One reason for this is that audiences are often not presented with learning activities allowing them to test and improve their skills in any meaningful way. Improvements in technology have allowed for improvements in the interaction between extension audiences and presenter through experiential learning. Simulation-based learning is one type of experiential learning that can be used to develop specific skills (Lean, Moizer, Towler and Abbey, 2006). In grain marketing, simulations are training devices used to increase producers' understanding of commodity markets and of how to manage commodity price risk in an educational setting.

As with any instructional method, simulation games contain both advantages and disadvantages. The primary advantage with a simulation game is that it addresses some of the limitations of the traditional teaching-and-learning paradigm (Ruben, 1999). In general, experiential teaching methods are interactive, encourage peer collaboration and facilitate active learning (Ruben, 1999). A survey by O' Rourke (2001) reported disadvantages related to simulations to be: the cost of updating and maintaining the

software, the lack of participants' adequate background, the time competition with other learning activities, and the difficulty to evaluate participants' performance. This chapter puts forward a grain marketing simulation game called Marketing in a New Era (hereafter MINE) that effectively addresses these drawbacks while being adaptable for a wide variety of audiences. The uniqueness of this grain marketing simulation game is that participants can create a realistic production setting (i.e., contains realistic yields, costs, etc.) and experience the marketing environment (based on historical prices) in a short time using common marketing tools (i.e., cash contracts, futures contracts etc.). Also, participants are able to review marketing results and ask questions all during the extension meeting, as well as keep exercising their marketing skills after the meeting through the on-line application of MINE. This set up allows for multiple simulation games to be played, resulting in a greatly enhanced learning experience. It is important to underline that the simulation allows each participant to operate at his/her own level and learn at his/her own pace. This function makes the game suitable for a variety of audiences. Furthermore, the ability for participants to be able to use values that are similar to the costs of their own farm, helps them conceptualize the game as an actual grain marketing environment. The utilization of common marketing tools and historical price series provides a realistic environment which is necessary to attract audience's attention. Immediate feedback is a desirable component that other grain marketing simulations played over a long period don't provide (Popp and Keisling, 2001). Finally, the on-line access to the game allows for unlimited self-paced repetitions of games with various historical price-series.

Agricultural markets are complex. At the beginning of the year, producers are faced with complexity stemming from unknown futures markets prices, basis, production costs

and production. Futures markets embody a large amount of information stemming from global supply and demand expectations while operating using specific rules for the particular commodity. Basis represents factors faced by local grain buyers that are passed on to producers. While futures and basis prices fluctuate, producers must also manage their own production expectations. Production costs represent all of the costs incurred to produce the commodity. Production represents the amount of grain produced given the particular set of weather conditions. While these factors appear independent they may not be. For example, in a pre-harvest environment (pricing grain in advance of production) forward contracting grain brings in yield risk because that grain must be delivered when the contract expires. This is especially true if the price-yield correlation is positive.

Producers use futures and basis contracts to hedge the possibility of prices moving against them, or lower. Hedging implies that at some point in the future, the futures contracts will be offset with sales of the physical commodity. Many times, hedging is oversimplified in the sense that is illustrated as a pure risk-avoidance tool only (Cramer and Wailes, 1993). MINE uses the pure risk-avoidance hedging as a departure point from which it is easier to introduce other types of hedging, as storage hedging and "pre-harvest" hedging as well as the returns to hedging.

The simulation game presented here demonstrates marketing in a way that is appropriate for producer grain marketing extension meetings, courses related to Economics of Futures Markets and also tradeshows such as "Husker Harvest days". The rest of the chapter is organized as follows. In Section 2, we compare and contrast previous simulations in Agricultural Economics and explain why a new grain marketing simulation is necessary. In Section 3, we describe how the principles of grain marketing are introduced in an

interactive way to several audiences. In the final section, we summarize the evaluations of the first introduction of the game in extension meetings in Nebraska.

## 2. Simulation games in Agricultural Economics

Simulations in agricultural courses have been a common tool over the last decades. (Stewart et al., 2000). The substantial difference of the games/simulations comparing with other conventional methods such as lectures or seminars is that through the game the participants control or experience various events and/or responses (Stewart et al., 2000). Also, they may convey economic information in a more effective and lasting way (Fels, 1993; Gremmen and Potters, 1997). By taking over the decision-making responsibility, participants become more active, leading to more motivation. However, the greatest significance of incorporating games/simulations in the educational process lies on the increasing awareness and understanding of principles, interactions and methods of analysis (Stewart et al., 2000).

Many universities had developed simulations for agricultural economics and agribusiness management courses. O'Rourke (2001) lists approximately 65 simulations and computer programs that are used in education. 14 out of 65 were used in courses related to agribusiness, futures and options, economics of futures markets, and risk management. However, as O'Rourke (2001) explains, there are no details identified for these games and no single simulation has dominated in agricultural economics programs. Thus, it is difficult to assess their efficacy in terms of improvement students' motivation, grade of realism, improvement of decision-making skills, risk management and, communication skills.

Some examples of grain marketing simulations that have been used in producer meetings are the "Winning the Game" and the "Commodity Challenge" from the University of Minnesota, and the paper based "Soybean Marketing Challenge" (Prop and Keisling, 2001) from the University of Arkansas. All three games teach producers how to market grain in a profitable way. The "Marketing Challenge" is an on-line game with an advanced set up that includes forward contracts and options. Even though it is useful for participants who want to monitor grain marketing using currently offered prices over a long period of time, the process of learning is relatively slow because its results are based on daily futures prices and it requires from the user to revisit the game many times in order to receive sufficient feedback. The "Winning the Game" as well as the "Soybean Marketing Challenge" are designed for half-day meetings and extension meetings. The main drawback of these games is that they don't give the ability to participants to play on-line and individually. Therefore, the number of repetitions is limited and the accessibility of the game is harder.

## 3. Uniqueness of Marketing in a New Era Simulation Game

MINE is a computer based simulation program created by the Department of Agricultural Economics at the University of Nebraska-Lincoln (UNL) aimed at improving producer marketing knowledge and abilities. MINE focuses on the marketing decision process using historical prices which are normalized to represent user entered current price levels. The ability to normalize historical price series to current price levels improves both the effectiveness and the efficiency of MINE. It is effective because the results are realistic since they are based upon previously experienced historical price series. It is efficient

because producers can experience different past market conditions using current price levels.

MINE is designed according to educational objectives and learning theory. Boehlje and Eidman (1978) propose that simulations in management courses contribute to the following three educational objectives: (1) Transfer of facts and economic principles. After the introduction of the principles, MINE allows participants to apply the concept of grain marketing, experience the process with actual historical prices, observe the results and reflect on those. The fact that the values of the game (prices, costs, interest rates) are lifelike, reinforces the understanding of the grain marketing concept, and makes the outcome believable. (2) Simulations increase analytical capabilities. MINE is designed in a way that gives the instructor the opportunity to identify the problem, to emphasize in the economic concept behind grain marketing and to the logical reasoning that will lead to a solution of the problem. The identification of the decision-making problem is hard to be taught in a static setting, MINE game serves this need by directly demonstrating the impact of sequential decisions in a dynamic environment. (3) Simulations enhance the ability of integrating facts and methods of analysis and enable users to make more informed decisions. MINE facilitates the integration of grain marketing theory with different methods of analysis for the pre-harvest marketing and the post-harvest marketing.

## 4. **Methodology and Applications.**

MINE approaches grain marketing as two distinct periods, pre-harvest and post-harvest. For the grain marketer, this is a logical break because risks and important market information change between these two periods. Pre-harvest marketing allows for yield risk

whereas in post-harvest, the production cycle is complete, and therefore yield is known. In post-harvest, the marketer focuses on price, carry and basis whereas in pre-harvest, harvest price and basis is the focus along with the crop insurance contract. This division in the marketing cycle makes the simulation more flexible, allowing participants to focus on what they are interested in. For example, if the producer feels more comfortable with post-harvest marketing they may choose to improve that type of marketing. Alternatively, they may desire to learn more about how pre-harvest marketing operates. Also, this distinction makes more salient the different marketing strategies that are followed in each case.

In the following discussion, we will evaluate pre- and post-harvest marketing periods independently. We will first discuss components of MINE which are similar between both periods. MINE provides a realistic trading experience by allowing the user flexibility in farm parameters. Parameters which can be modified are: crop, crop acres, expected yield (or yield in post-harvest), current price, bushels in storage, costs associated with production (pre-harvest) or storage (post-harvest), crop insurance (pre-harvest), marketing periods, and financial ratio calculator (pre-harvest). Crop selection identifies the crop being sold during the trading simulation, allowing the user to market specific crops independently, partially based upon their knowledge of the crop and the instructor to underline the specific characteristics of each grain regarding the marketing process. For example, soybeans are deemed as a relatively low-margin crop, which means that grain marketing can determine whether the production will be profitable or not. (Popp and Keisling, 2001). This allows MINE to be more realistic because it is using information on how these commodities operate (for example, using real world soybean futures in soybean marketing simulation). Crop acres identifies the number of acres planted to a crop. The

ability to modify crop acres allows the user to represent crop acres in their local area. Crop acres interacts with the number of marketable bushels, actual farm yield which interacts with the crop insurance policy, and production cost. Expected yield represents the per acre yield expected to be harvested pre-harvest. Expected yield interacts with crop acres to identify the total expected production and crop insurance to identify per acre guarantees. In post-harvest, yield is the amount of bushels which were harvested. Current price represents the current cash price, allowing the simulation game to be based on prices users are seeing today. Bushels in storage indicates the number of bushels the producer has available to market during a post-harvest simulation. Costs are broken down into both pre-harvest, which represents commodity production costs and post-harvest which represents storage costs.[1] Administrators can enter production costs based upon the region, which improves simulation accuracy with local conditions. Marketing periods identifies the number of times the user can make marketing decisions. The minimum is three periods and the maximum is twelve. Variation in the number of marketing periods provides users flexibility to meet their objectives. If the user wishes to experience many scenarios then they may select fewer marketing periods. If the user wishes to spend more time in a scenario analyzing the markets then they will select more marketing periods. So, the game is adjusted on the audience's needs in order to succeed the highest effectiveness combined with the lowest possible fatigue. In addition, the duration of the game purposely is flexible to fit with any previous learning activities of a meeting.

Finally, one of the most important and innovative components in both pre-harvest and post-harvest options is the fact that the prices which the participant faces come from

[1] There is a break-even price in the post-harvest simulation representing per bushel production costs.

previously experienced historical price series, started from 1990. That is, the prices of each marketing year are stored in MINE. The instructor selects a marketing year and creates the price scenario that will be used in the upcoming simulation. Because of the long-term trends that have occurred between 1990 and now, prices series are normalized and adjusted to the current nominal prices. Participants do not receive any information about the prices before the completion of the game. When the game is over, producers justify how they priced their grain and the instructor leads a group discussion following each simulation. The discussion allows users to better understand which strategies worked best under the specified conditions.

*Pre-Harvest Marketing*

The goal of MINE pre-harvest marketing is to evaluate the relation between profitability from forward contracting before and during the growing season and risk of producing a crop. In order producers to have a reasonable return from the pre-harvest marketing, knowledge of basis's behavior and knowledge of the relationship between local cash price and futures price in the delivery month is required. (Cramer and Wailes, 1993). The MINE's Pre-Harvest Marketing aims to demonstrate to participants how to cope with yield risk along with price risk by forward pricing part of the expected grain during the growing season. Producer selects from a variety of insurance contracts associated with insurance type (yield or revenue) and coverage levels (50 to 85% in 5% increments). The inclusion of crop insurance in the simulation provides a realistic situation in today's pre-harvest grain marketing environment.

Another feature of the pre-harvest marketing simulation is the financial ratio calculator. The intention of the financial ratio calculator is to identify changes in important

financial ratios stemming from marketing decisions. The financial ratios used in MINE are important to bankers because they help decide if capital will be provided to producers or not. Producers influence financial ratios through outcomes from the grain marketing simulation game. Four financial ratios are considered in the module and each is determined by farm financial return. The Current Ratio is a liquidity ratio that indicates whether a farm is able to pay its liabilities with assets.[2] It carries important information because the higher the ratio the larger the proportion of assets compared to the value of liabilities. The Net Farm Income Ratio, is a significant efficiency ratio because it indicates the proportion of production that remained as net income in the farm (FBP Module 8, 2004).[3] The Term Debt Coverage Ratio is an indicator of the ability of the producer to cover the term debt.[4] Finally, the Operation Profit Margin Ratio is a profitability ratio that shows how efficiently the farm converts production into returns (FBP Module 8, 2004).[5] Each financial ratio requires starting values, which are obtained by Nebraska Farm Business Inc. (NFBI). NFBI collects financial data from producers who are part of the NFBI program. NFBI financial data is broken into four regions in NE: [North East, South East, South Central and Western]. Users select their region from a map of Nebraska.

As with the post-harvest version of MINE, pre-harvest games use actual historical price series in the simulation as well as predetermined yield.[6] Participants have the

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[2] Current Ratio= $\frac{current\ assets}{current\ liabilities}$

[3] Net Farm Income Ratio= $\frac{Net\ farm\ income}{Value\ of\ production}$

[4] Term Debt Coverage Ratio= $\frac{Revenue-Expense+Non-Fram\ Income-Family\ Living\ Expenses\ and\ Income\ Tax+Interest\ on\ Long-Term\ Loans}{Principle\ and\ Interest\ on\ Long-term\ loans}$

[5] $Operating\ Profit\ Margin\ Ratio = \frac{Net\ Farm\ Income+Interest\ Expense-Returns\ to\ Unpaid\ Labor\ and\ Management}{Value\ of\ Production}$

[6] The instructor sets the final yield based on the chosen price series. If the price series is 2012 corn then the final yield would be lower than the expected yield to reflect the drought.

opportunity to forward price expected production during different milestones (figure 1). Depending upon the actual number of bushels harvested (at the end of the game) there may be an insurance claim. Participants have the option to purchase a crop insurance contract at the beginning of the game. This structure facilitates the discussion about the importance of crop insurance and the type of crop insurance contract (yield or revenue). Cases where producers have decided to not buy insurance at the beginning of the game and they ended up with negative profits due to low production are good examples of how experiential learning works. Producer experiences are challenged through what they learn from MINE. This intersection results in an update of thought, and modification of the existed knowledge, (Percy, 2005) recognition of ignorance, re-thinking etc. "aiming to establish renewed contact with something original" (Malinen, 2000).

*Feedback from Pre-Harvest Marketing*

Right-after the completion of the pre-harvest game participants review their personal decisions and the corresponding profit or loss. The pre-harvest group review ranks participants marketing from the most profitable to the most unfavorable, taking into consideration the insurance selected and the costs. The instructor along with the audience goes through the results of the entire group. Ideally, all participants will share with the audience what were the factors that drove their decisions. Peer learning allows individuals to re-shape their perceptions and to learn about the diversity in approaches.

*Post-Harvest Marketing*

The goal of MINE's Post-harvest marketing is to underline the interaction between profitability and risk associated with storage decisions. For this reason, it allows participant to create a marketing strategy using a combination of cash, futures and basis contracts (Figures 2, 3 and 4). MINE aims to teach producers how to make decisions based on economics and market signals. For this reason, it analytically displays the calculations behind the expected cash under any given price. Although future contracts are not used for actual purchase or sale of grain, they serve as temporary substitutes for intended later transactions in cash. MINE demonstrates how hedgers who have spot market position should use futures contracts as risk management tool. Basis and futures are marketing components that are directly connected with such decisions, and producers should take into consideration how these components behave. Changes in futures price reflect changes in expectations regarding future supply and demand conditions. Also, changes between two futures prices (carry) reflects a change in demand and supply conditions across delivery months. A highly positive carry encourages producers to store the grain and earn the cost of carry through hedging (Cramer and Wailes, 1993). Producers should be able to recognize these signals and adjust their marketing plan.

Despite the fact that basis risk is lower than price risk as we go towards the expiration of the futures contract, transportation costs and local supply and demand issues can generate large differences in basis even in locations that are not too far. For example, plentiful local supply results in a large negative basis while shortage in local market results in a smaller negative or even positive basis. Generally, basis is more meaningful for grain trade than as an absolute price. To a grain merchant a basis of 10 cents under, carries more

information than a quoted price of $3.5. That happens because basis is an indicator for how expensive is the cash grain relative to futures. Also, hedgers that have opposite positions in futures and cash markets are more interested in basis changes than in price itself because basis will determine their revenue.

*Feedback from Post-Harvest Marketing*

The purpose of the feedback is to help people learn about their approach towards price risk given that particular year's price movement. They also discover diverse approaches to grain marketing (Stewart et al., 2000). The feedback at the end of the game is provided to participants in order to have both demonstrated and witnessed that even though all face the same market conditions and farm characteristics, the results range from the loss of capital to large profits. This helps the coordinator of the workshop to lead a discussion on issues that further the learning opportunities (Stewart et al., 2000). More specifically, MINE provides immediate feedback for each participant separately as well as for the group. Firstly, producers individually review their decisions throughout the game and their performance in terms of net revenue (figure 5). Secondly, they receive feedback related to if they would have sold every bushel at harvest (figure 6). A positive difference shows how much of the revenue would be forgone with no post-harvest grain marketing. This difference appears as percentage of the net revenue at harvest, and a monetary difference. Moreover, this summary screen (figure 6) provides detailed analysis about the impact of each marketing component (basis, futures, and cash) on the net revenue.

Regarding the collective results, during the game players' decisions are stored in instructor's computer, where the results from the entire group are compiled. At the end of the game the instructor shows several graphs. Firstly, a graph (figure 7) summarizing the

results of the group ranked in descending order is shared with the audience. Participants along with the instructor, go through the results and they review the strategies that they were followed. Additionally, users compare their marketing outcome with a number of different benchmarks. The first comparison is related to the maximum possible revenue. That is, the revenue that the producer could hypothetically achieve if she had sold the entire amount of grain in the highest price of the year. The second comparison shows how many participants were better off after using grain marketing and how many were worse off.

Secondly, the instructor displays a series of two more detailed graphs that show to what extent the decisions of the participants were consistent with grain marketing theory. Figure 8, identifies the range of bushels sold by each participant, the average amount sold and the cash price for each milestone. The teaching point is the discussion on the relation between bushels at each milestone and cash price. Figure 9 describes the number of bushels contracted for future delivery for each participant and the futures carry. The value of futures carry reflects the difference in a differed futures contract and the nearby contract. When positive, the differed contract is a higher price than the nearby, implying more revenue in the future. Of course, the participant must deduct the storage cost to identify if the benefit is greater than the cost. The discussion point is that participants are expected to take advantage of the futures carry if the value is greater than the expense of holding the grain to that point in the future.

At the end of each Extension Meeting or other short of workshop, after covering both pre- harvest and post- harvest games, the instructor informs participants of the on-line MINE edition and encourages them to keep practicing on how to make marketing decisions. The MINE on-line version provides the opportunity to participants to play

individually.[7] The on-line version allows participants to parameterize the simulation in a way that depicts exactly the conditions of their own farm. Moreover, even if in extension meetings and workshops each player works with her own pace, there is an objective time constraint. On-line version allows for unlimited repetitions of the price scenarios that are available without any time or other constraint. In this case, the individual receives feedback related to her current performance, to her past performance in the same game as well as to the performance of all other participants that have played this game before. Thus, the individual can evaluate her effort and also assess her progress from game to game.

In addition, the on-line version provides MINE unlimited equipment capacity. Instructors usually use the mobile MINE lab which has a limited number of laptops available for participants. However, if the participation is high, participants can use their laptops and connect with MINE through internet.

## 5. MINE Accomplishments

Between November 2015 and March 2017, there were 33 Nebraska Extension MINE Grain Marketing workshops across Nebraska for a total of 426 participants have played it. At the completion of each workshop and 6 months following the workshop participants evaluated their knowledge and behavior change as a result for attending a Nebraska Extension Grain Marketing workshop. Eighty-seven percent of the participants had never written a grain marketing plan before the workshop. Following the workshop 92% indicated they were planning to write a gran marketing plan. One of the purposes of the workshop was to increase grain marketing plan implementation. In the 6-month follow

[7] On-line MINE is accessible even for individuals that have not attended a grain marketing meeting before.

up survey 40% of respondents indicated they had implemented a marketing plan for at least one commodity. An additional object of these workshops was to increase and sustain participant's knowledge of price patterns, basis and carrying charges. To measure knowledge change, participants rated their knowledge of each of these topics on a scale from 1 to 7 prior to the workshop, and after the workshop, then again on the 6-month follow up survey. On average, participants increased their knowledge of each subject, 0.8224 points from their pre-workshop levels to their post-workshop levels. On average, 6-months following the workshop participants rated their knowledge as high as or higher than the post-workshop results.

MINE played a critical role in the learning experience for participants. 42% of participants rated MINE as "Effective or Very Effective" in improving their understanding of grain marketing. 22% of participants rated MINE as "Effective or Very Effective" in improving their grain marketing skills.

Here are a few comments participants made regarding MINE.

*"All Extension Educators did a great job at educating the classroom with real-life scenarios that should be considered everyday on the farm. It was easy to relate to the information and understand how the online application could be a powerful tool."*

*"Having the chance to actually do the computer marketing program and then able to compare our marketing plans using different selling times…"*

*"Nice combo of lecture and hands on."*

# 6. Conclusions

In this chapter, we introduced and motivated the use a grain marketing simulation called Marketing in a new Era (MINE) as an alternative instructional tool for classes and/or workshops related to grain marketing. MINE's strength is the ability for producers to participate in multiple marketing periods and receive feedback during the seminar. MINE is separated into two distinct marketing periods pre-harvest marketing and post-harvest marketing. The ability for MINE to operate in pre- and post-harvest periods allows the instructor to explain thoroughly the different marketing strategies that apply in each period. Also, gives participants the opportunity to experience these strategies and improve their marketing skills. Emotions among the players range from satisfaction and excitement to even frustration. In any case the goal of the Extension program has been achieved. Producers have been exposed in the key elements of grain marketing and they have obtained the right mindset. Additionally, the chapter provides an overview of the impact of MINE in Nebraska Extension Meetings since its first introduction in 2015.

# 7. Figures

Figure 1: Pre-Harvest Marketing Screen

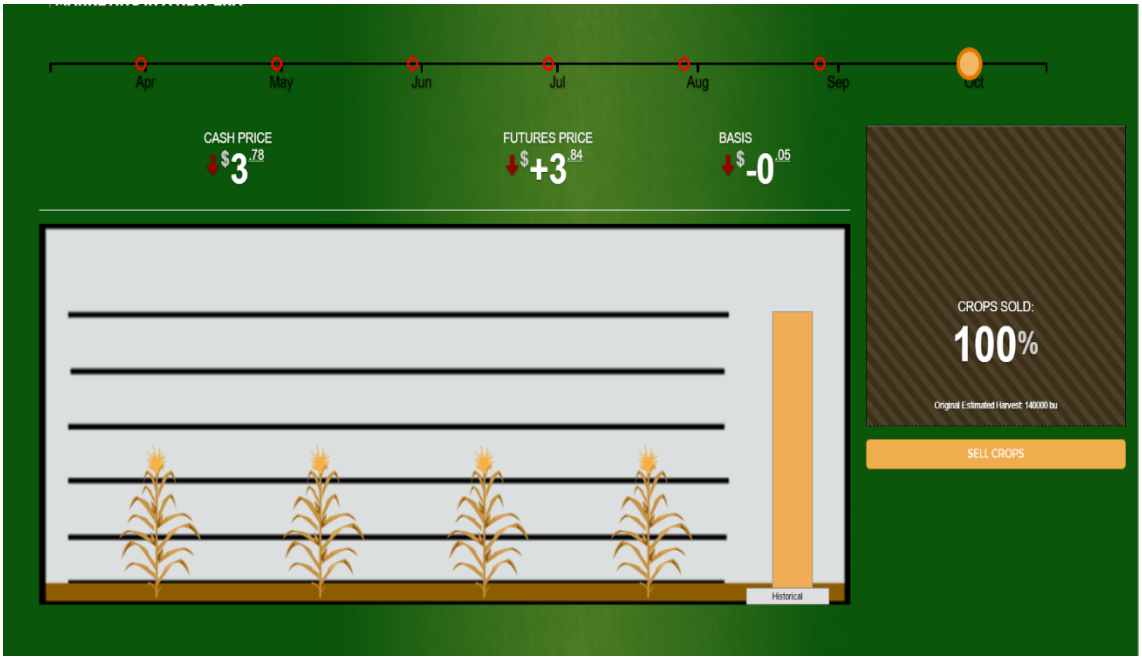



Figure 2: Post-Harvest Price Table. Participants can create cash, futures and basis contracts

Figure 3: Post-Harvest Futures Market Analysis. This table shows the economic determinants that should drive producers' decisions.


Figure 4: Simplified introductory version of the Post-Harvest Price Table for less experienced audiences, where participants create only cash contracts.

Figure 5: Individual Revenue Summary


Figure 6: Comparison of net revenue with and without grain marketing

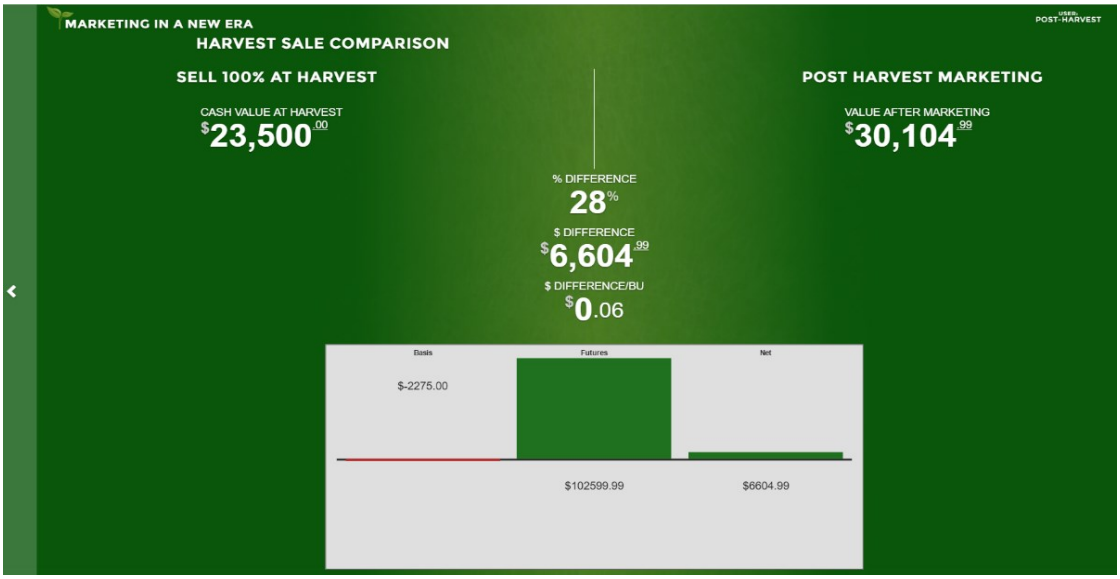


Figure 7: Group Review. Participants' performance is ranked in descending order

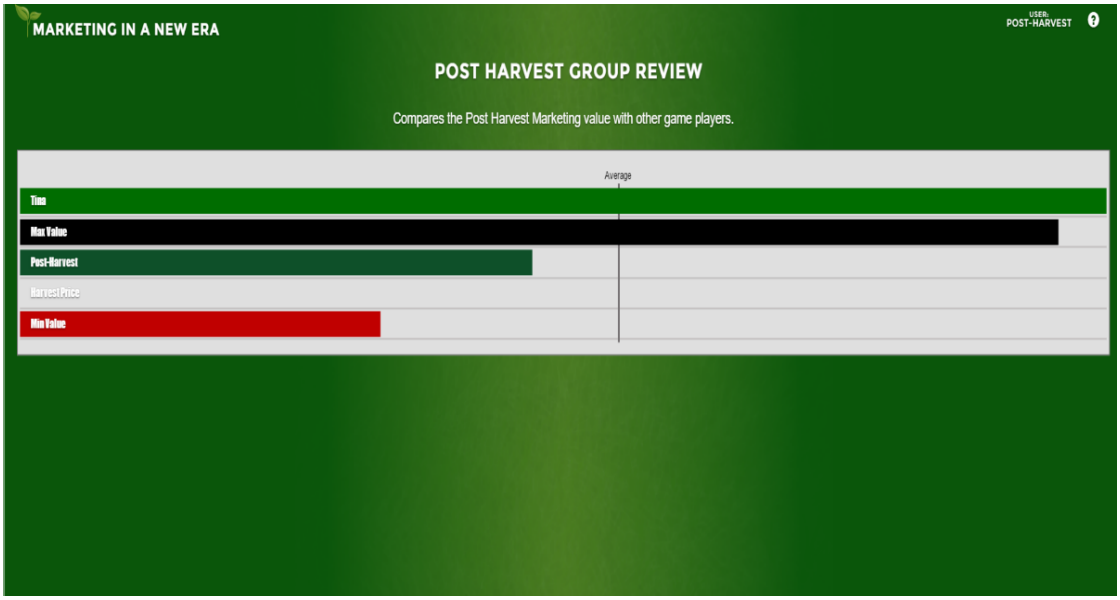



Figure 8: Total Amount of transactions per month compared to the respective cash price.

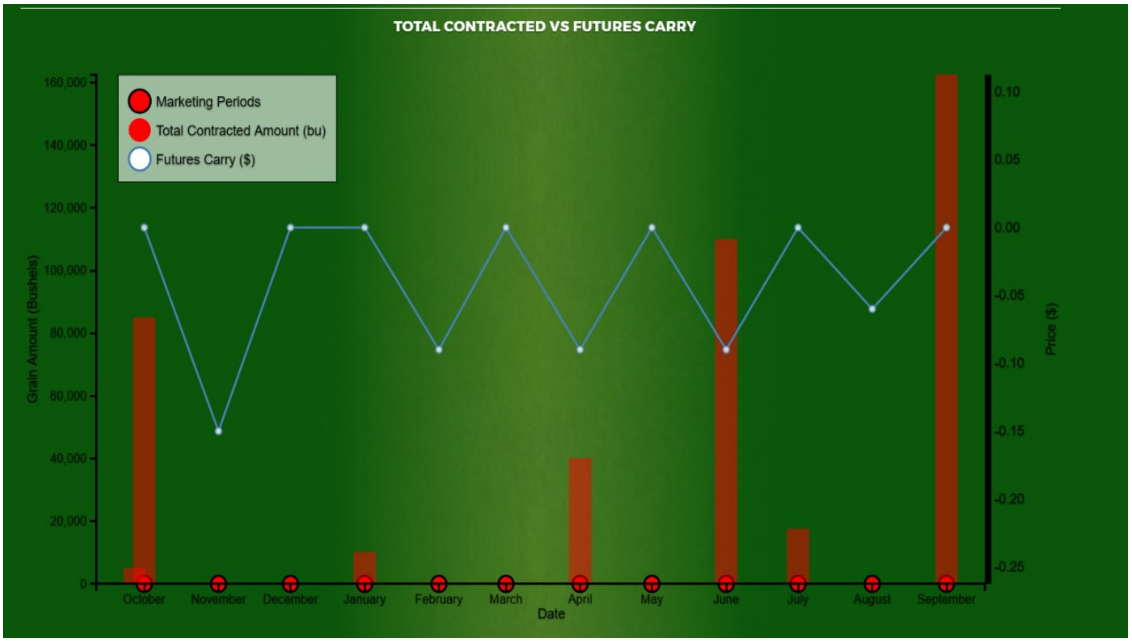
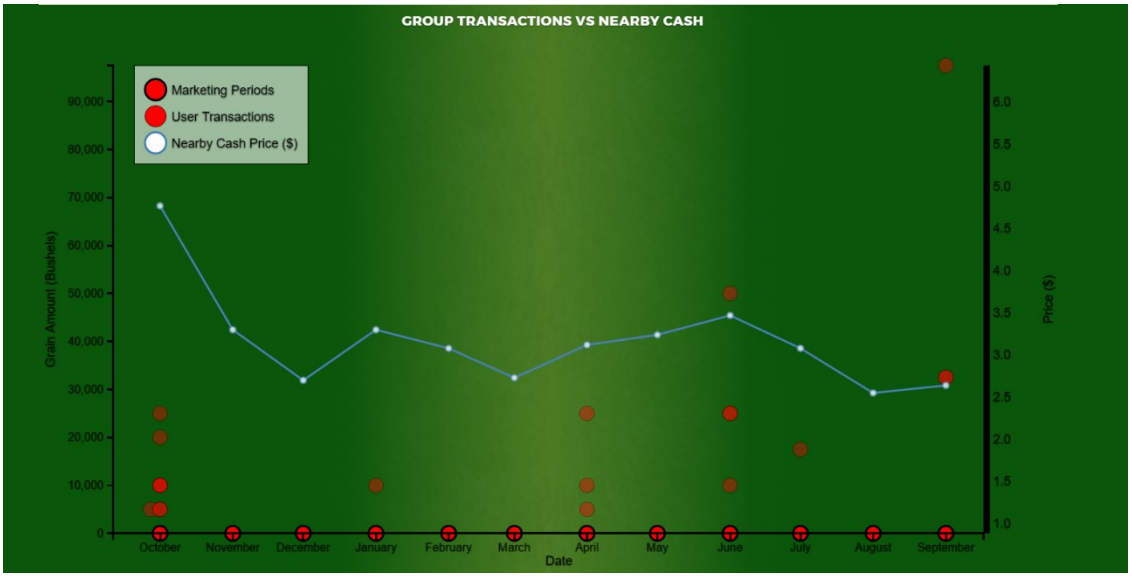


Figure 9: Total contracted amount in bushels per month compared with the futures carry.



# CHAPTER 2

## THE ROLE OF SAFETY FIRST PREFERENCES IN GRAIN MARKETING DECISION MAKING: EVIDENCE FROM A CONTEXT RICH ECONOMIC EXPERIMENT

# 1. Introduction

Improving our understanding of the influence of risk preferences on decision making represents an important goal for economists. This problem is especially true when it comes to the marketing of grain. A primary barrier comes from the difficulty of identifying linkages between the grain marketing decision process and economic principles. (Kastens and Dhuyvetter, 1999). Grain marketing research has primarily focused on the use of different marketing techniques that result in lower price risk and, therefore, lower income risk (Musser, Patrick, Eckman, 1996). However, the extent to which these theoretical findings are relevant to real world applications is not clear (Brorsen and Irwin,1996; Garcia and Leuthold, 2004). While reducing income risk is desired it ignores the influence of producer risk preferences when marketing grain. A potential reason for these research limitations appears to be the lack of data on producers' grain marketing decision behavior (Tomek and Peterson, 2001), as well as on producers' risk preferences. However, it is important to understand how producers make decisions in order to provide better marketing advisory services and in order to reduce the divergence between the theoretical and empirical findings on grain marketing. As Kastens and Dhuyvetter (1999) suggested, for producers to incorporate the proposed methods in marketing decisions and trust research results, it is important to use less aggregated, more comprehensive and simpler empirical processes. In this chapter, we build an economic experiment to evaluate the role of producer risk preferences (in particular, we focus on Safety First risk preferences) on grain marketing decision behavior.

Economic experiments are suitable for this research since they allow the controlled testing of human behavior in a wide variety of context neutral and context-rich settings

through systematic variation in one or more variables of interest without the possibility of confounding. Additionally, the economic experiment in this study resolves the limitation of lack of data in grain marketing decisions at an individual level.

We conduct a context-rich lab experiment to explore the relation between individuals' risk preferences and post-harvest grain marketing decision-making. Our experiment has three stages. In the first stage, we use the context-free risk elicitation tasks developed by Levy and Levy (2009) to evaluate whether Safety First (SF) risk preferences are present. The results of the first stage allow us to directly elicit subjects' SF risk preferences. Also, the results from Stage 1 allow us to verify if the lab measure proposed by Levy and Levy (2009) could predict real world farming behavior (Hellerstein, Higgings, Horowitz, 2012).

The second stage of the experiment involves a computer simulation game, called Marketing in a New Era (MINE).[8] In this stage, subjects make multiple post-harvest grain marketing decisions by creating contracts for spot or future grain delivery under four different grain price scenarios. In making these decisions participants face price uncertainty only since production is known under all scenarios. Also, participants incur a production cost that is fixed and a storage cost that varies according to their marketing decisions. Finally, after the completion of stage 2, a socio-demographic survey follows. The conclusions of this study are based on the combination of participants' grain marketing decisions with their risk preferences and their socio-demographic characteristics.

To the best of our knowledge this is the first study that experimentally tests the impact of risk preferences on grain marketing decisions. Also, it is one of the first studies

[8] A detailed description of MINE game is provided in Chapter 1. In this chapter, the features of the game will be briefly discussed when it is necessary.

that incorporates the dynamic characteristic of storage cost as it appears in real world. The majority of grain marketing studies do not have the ability to evaluate the intra-season hedging decision. Especially for post-harvest marketing, grain storage is conceptually considered as an all-or-none decision (Kastens and Dhuyvetter, 1999), although many studies have shown that producers market their crops with greater frequency than once during the marketing year (e.g. Goodwin and Kastens, 1996; Katchova and Miranda, 2004). However, as Kastens and Dhuyvetter (1999) indicate, studies that explicitly consider storage costs under alternative marketing strategies may be more useful for producers.

The primary objective of this study is to identify how risk preferences affect grain marketing behavior. Our literature review indicates that until 2015 there has not been a study that experimentally examines producers' behavior and output price (Lee, Bellemare and Just 2017). Moreover, as Ruhinduka et al (2017) state, studies that have investigated behavioral attributes (risk preferences, time preferences etc.) have mainly focused on pre-harvest decisions. Additionally, behavior in the grain marketing simulation game can be used to address important economic questions which might exert considerable cognitive load on the decision-making agent. In that sense results of this study could demonstrate the role of simulation games in providing opportunity for hands on experiential learning at the individual level.

The rest of this chapter is organized as follows. Section 2, describes grain markets and explains the role of risk preferences in grain marketing decisions. Also, Section 2 presents previous studies related to risk preferences and grain marketing as well as literature related to simulation games and experimental economics. Section 3 reproduces Levy and Levy decision-making theory, Section 4 describes the experimental design,

Section 5 presents the summary statistics and the econometric results, Section 6 discusses the conclusions and Section 7 provides directions for further research.

# 2. Literature Review

## 2.1. Grain Marketing Environment

Grain marketing represents a critical step for producers because it transforms production into dollars that are then used to pay bills. The economic health and financial sustainability of many farms and rural communities relies on the efficiency of grain industry (Cramer and Wailes, 1993). Therefore, the grain pricing system, among its other functions, determines the acres of production as well as the farm income (Cramer and Wailes, 1993). For a greater understanding of the factors which influence grain marketing decisions, it is essential to understand how grain markets work.

In grain trade, agreements between buyers and sellers occur through a variety of contracts. A sales contract is "an agreement between two parties to exchange commodity for money or for another commodity" (Cramer and Wailes, 1993). This agreement specifies the price, the quantity, and the time of delivery.[9] Contracts can be created anytime throughout the production year, leaving no limit to the number of contracts that a producer can execute. To simplify the producers' complex marketing environment, contracts can be classified based on whether they occur before or after harvest, and whether the time of delivery is different from the time of contracting. Contracts that take place before harvest are classified as "pre-harvest". Contracts that take place after harvest are classified as

[9] Depending on the type of contract additional specifications may be required e.g. quality of grain, place of delivery etc. For detailed analysis of the different types of contracts refer to Cramer and Wailes 1993.

'post-harvest'. The primary difference between pre- and post-harvest marketing periods is that in pre-harvest there is yield risk additionally to price risk, since the production has not been determined yet.[10]

In pre-harvest marketing decisions producers must take into account expected production and production costs. Production risk matters when a positive price-yield correlation exists. That is, not being able to deliver on contracted bushels could result in buying out of contracts at a higher price, which would be financially costly. Post-harvest marketing decisions revolve around the prospect of positive returns to storage. There are two primary ways to earn positive returns to storage. First, which is the least risky, is to use the futures market carry, if one exists, and forward contract for delivery in the future. Second, which is the riskiest, is to leave grain unpriced in hopes of a futures market rally.

Time of contract delivery is the other marketing classification. Contracts that are written to be delivered upon immediately are classified as 'spot delivery' or cash contracts and those that are written to be delivered upon in the future are classified as 'futures contracts'. For spot delivery contracts, contracted grain is sold at the current spot price and delivered. Logically, spot delivery contracts occur during the post-harvest marketing since grain must be on hand to deliver. For futures contracts, grain is priced in advance of delivery. For example, grain may be priced today for delivery in two months. Futures contracts can be applied to either pre- or post-harvest marketing periods.

While the functionality of grain marketing is relatively straight forward, implementation of a grain marketing strategy involves decision makers. Decision makers

[10] There is no specific day that pre-harvest marketing ends and post-harvest marketing begins. A reasonable starting point for post-harvest marketing is when 50% of the crop is harvested, but depending on the producer, post-harvest marketing might start earlier or later than this threshold (Kastens and Dhyvetter, 1999).

who contain risk preferences. Producers need to decide the amount of risk they are willing to accept, or stated in a different way, decide how much they are willing to pay for a safer income (Cramer and Wailes, 1993).

## 2.2 Risk Preferences and Grain Marketing

Decision making under risk has been investigated in a considerable amount of experimental literature in either laboratory or field setting (Menapace, Colson, and Raffaelli, 2012). This topic is of interest because risk is involved in a broad spectrum of decisions that producers make on daily basis. Hence, a better understanding of the relationship between risk and behavior observed in real world (field behavior) is important (Hellerstein, Higgings, Horowitz, 2012). Several studies show that producers' risk preferences influence many aspects of farming decisions such as crop-selection and rotation (Maynard, Harper, Hoffman, 1997), purchase of crop insurance (Sulewski, Gajewska, 2014; Niewuwoudt and Bullock 1985), and technology adoption (Liu, 2013; Chavas and Holt, 1996).

In this sort of studies (e.g. technology adoption and risk preferences), the variable of interest (the final decision), is observable in national, county, and even in farm level. Thus, a direct evaluation of the behavior traits that are associated with a specific field behavior is possible. In grain marketing, market data can be used to analyze market behavior since the contract volume, the prices and the bushels traded are recorded in daily basis. However, this data cannot uncover the way producers' approach their grain marketing decisions. The reason why market data cannot uncover how producers approach grain marketing, is lack of access to data on some of the key variables of interest. Such

variables are the number of contracts that the producer created, the amount of grain that she contracted each time, the price at which the grain was sold, and the producer's risk attitude. To address market data issues, researchers survey producers about their grain marketing strategies, their familiarity with futures markets, the percentage of grain that they trade through futures or other contracts, as well as their perceptions towards risk. This way researchers obtain an overall idea about producers' behavior.

Musser, Patrick and Eckman (1996) surveyed 62 large scale Midwestern cash grain farmers and determined the effects of farm characteristics and risk attitude on pre-harvest marketing tools. They found that large-scale farmers forward contract mostly with cash forward contracts. Also, the level of forward pricing is lower than what other theoretical studies recommend. Katchova and Miranda (2004) investigated how farm and personal characteristics affect the adoption of marketing contracts as well as the quantity, the frequency and the type of contact chosen. Their main finding was that the personal and farm traits predominately affect the contract adoption decision rather than the quantity, frequency etc. Also, they concluded that more specialized producers contract less production but more frequently. Davis et al. (2005) analyzed the forward pricing behavior of corn and soybean producers through a random survey that was mailed to different states. They found that producers use forward pricing techniques before and after harvest and they tend to use the similar marketing approaches every year. Additionally, they showed the limitations of the hypothesis that forward pricing decisions can be approached as technology adoption decision. Sartwelle et al. (2000) surveyed producers from several states in order to study the personal and farm characteristics on grain marketing practices. They concluded that personal and business attributes affect the use of alternative cash,

forward and other types of contracts. Goodwin and Kastens (1996) evaluated the marketing frequency of different crops (number of times per season that a crop is marketed) in Kansas. Their results did not verify the assumption that risk perceptions are key determinants in grain marketing behavior, since producers' risk attitudes had small effect on frequencies of marketing. Shapiro and Brorsen (1988) conducted a survey about the factors that affected farmers' hedging decisions and concluded that risk aversion is not a significant factor.

Except from surveys, we found three studies that used artefactual field experiments" (Harrison and List, 2004) in order to examine marketing strategies with less aggregated data and producer-specific characteristics.[11] Ruhinduka et al. (2017) experimentally elicited time and risk preferences in order to explain storage and processing decisions of Tanzanian Rice Farmers. 337 randomly selected households from different areas in Tanzania participated in a detailed survey about rice production and processing. In addition, producers took part in an experiment that elicited their risk, ambiguity and time preferences. By linking the experimental parameters with field behavior researchers concluded that relatively risk neutral and patient individuals is more likely to store. Moreover, relatively risk neutral, young and educated individuals is more likely to process their grain. Their experimental results showed that the methods used for time and risk preferences predicted the observed behavior in contrast with other studies where the predictive power was low.

[11]"In artefactual field experiments, researcher uses experimental subjects from the market of interest" (List, 2008) who in this case are the producers and also, departs from the sterility of the laboratory environment (Harrison and List, 2004) and introduces the field context in the tasks (List, 2008), which in this case are grain marketing scenarios.

Lee, Bellemare and Just (2017) approached individuals' pre-harvest grain marketing decisions with a context-rich economic experiment that they conducted with various samples.[12] In their study, Lee, Bellemare and Just (2017) used experimental methodology to test how individuals that assume the role of a firm manager make their decisions about the production level of the firm under price risk compared to price certainty. Risk preferences were elicited through the Holt-Laury (2002) multiple price lottery game. The conclusion of the study was that under price risk, individuals decided to produce more than when price was known for certain. Nevertheless, conditional on the existence of price risk, an increase in risk level led subjects to reduce their production levels. Moreover, Mattos and Zinn (2016), ran a dynamic experiment to investigate how producers in Canada form and update their reference prices when they market their grain. They found that current market prices, price trends and producers' own price expectations are the main determinants of the formation and the updating of reference prices.

Finally, a study that does not link grain marketing decisions with individuals' risk preferences but it shows the need for testing whether post-harvest marketing storage decisions are profitable is the one by Kastens and Dhuyvetter (1999). Their research relied on a simulation of post-harvest marketing scenarios across different crops, futures and basis cash price forecasts, storage cost scenarios and locations in Kansas. Based on the significance and consistency of the results, the authors failed to reject the hypothesis of cash market efficiency. That is, there was no evidence that the calculation of expected

[12] Contextualization is not typical experimental protocol (Ward et al., 2008) however its adherents support that context-rich experiments may tell us more about individuals' reactions in specific real world contexts (Ward et al., 2008).

returns to storage from deferred futures plus historical basis is an appropriate way to make grain storage decisions.

In summary, the literature that explores risk preferences and grain marketing with primary data uses mainly surveys (Davis et al., 2005; Sartwelle et al. 2000; Goodwin and Kastens, 1996) or no random samples (e.g. Shapiro and Brorsen, 1988; Musser, Patrick, Eckman, 1996). The instruments used to measure risk attitudes are mostly Likert-type or other type self-assessed scales (e.g. Musser, Patrick, Eckman, 1996; Davis et al. 2005; Shapiro and Brorsen, 1988; Sartwelle et al. 2000; Goodwin and Kastens, 1996; Mattos and Zinn, 2016). Only three studies by Lee, Bellemare and Just (2017), Ruhinduka et al. (2017), and Mattos and Zinn (2016) used experimental methods to elicit risk preferences.

## 2.3 Simulation Games and Experimental Economics

Simulation games have been widely used in experimental economics because both (games and experimental economics) focus on replicating real world as faithfully as possible (Borawski, 2016). Friedman, Pommerenke, Lukose, Milam, and Huberman (2006) tried to isolate the features that reinforce or discourage the sunk cost fallacy by using a "Treasure Hunt" computer game. Participants were trying to find various amounts of "buried treasure" in several "islands" and researchers measured if the cost of approaching an "island" influences their insistence of finding the treasure. Kimbrough and Wilson (2013) used a virtual world to investigate the effect of an exogenous ecological shock on the informal principles of property rights and exchange. They tested how an ecological shock as a severe drought can cause institutional evolution and replace private property with new informal routines. Dorschner and Musshoff (2015) incorporated a

business simulation game in a 4-stage experiment in order to test if incentive-based nature protection policies reduce biodiversity losses.

In general, simulation games can serve the experimental design in a broad range of economic research. To the best of our knowledge, an experiment with a grain marketing simulation game hasn't been conducted yet. As a result, MINE represents an excellent opportunity to investigate the behavior of producers towards price risk in a grain marketing. Its software flexibility allows the experimenter to design experiments as simple as possible and as complex yet realistic as necessary keeping in mind the grain marketing knowledge level of the subject pool. Decision-training games as MINE can be a tool in researching human behavior and interactions (Borawski, 2016). Because of their education-oriented character, they are accessed by a large group of people, which increases the generalizability of the simulation results. Moreover, economic experiments involving human subjects require their maximum engagement, which is difficult to achieve. Games are a useful tool to attract the subjects' attention (Borawski, 2016). Recent sociotechnical developments involving computer games have created new kinds of research in the social and behavioral sciences (Bainbridge 2007).

# 3. Theoretical Background

## 3.1. Safety First and other decision criteria

As it was mentioned in our Introduction, in this study we experimentally test the applicability of Levy's and Levy's (2009) Safety First – Expected Utility (SF-EU) decision rule on grain marketing decisions. Levy and Levy developed a decision rule that is a hybrid between Safety First criterion and standard expected utility maximization. Also, they empirically investigated the robustness of their model by designing an experiment with

context-free tasks that elicited participants' SF preferences. In this Section, we reproduce and discuss Levy's and Levy's work, since we use in our study their theoretical approach as well as their experimental tasks to associate the EU-SF preferences with grain marketing decisions. First, it is important to recall the SF criterion. Roy (1952) suggested that under uncertainty individuals are more concerned with avoiding "a disaster" than with reaching the maximum net increase in satisfaction.[13] Different individuals may set different disaster levels. Roy (1952) provided as potential examples of disaster the net loss out of an economic activity, or the lowest income made in an occupation than what another occupation would yield. The principle of SF asserts that since for many people the idea of a disaster exists, it is sensible that, in practice, they try to minimize the probability of this catastrophe. Levy and Levy (2009) formally described SF criterion as follows:

Consider two alternative prospects F and G and a "disaster" level d.

F is preferred to G if and only if:

$Pr_F(x < d) < Pr_G(x < d)$,

that is, prospect F is preferred to prospect G if the probability of experiencing an outcome lower than the disaster level (x<d) is lower under prospect F than under prospect G. However, as Levy and Levy explain, the strict implementation of the SF criterion where individuals solely seek to minimize the probability of a bad outcome to happen, may lead to paradoxical behaviors. They provide the following example:

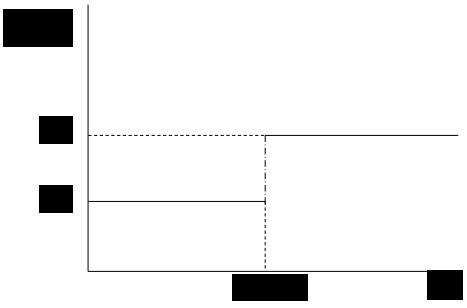
[13] Roy's major objections on approaching behavior under uncertainty with expected value or utility maximization principles are the following: 1) Expected utility maximization requires an individual to consider all possible outcomes of a given prospect and find the expected outcome if this action was repeated many times. 2) It is not necessary that an individual has a precise knowledge of the probabilities of all possible outcomes of an action and furthermore, it is not necessary that she is able to extend her knowledge about what future holds.

| Prospect F | Prospect G |
|---|---|
| $ 0.01 with certainty | $ -0.01 with probability 0.1% |
| | $ 1,000,000 with probability 99% |

A strict implementation of SF rule implies that prospect F dominates G because it minimizes the probability of a negative outcome. Nevertheless, it is obvious that the majority of people would prefer prospect G, because the distribution of the outcomes matters too. What Levy and Levy suggest is that even though SF matters in decision-making process, is not the only factor that is taken into consideration when making decisions between risky prospects.[14]

Levy and Levy (2009) conducted a two-stage experiment to evaluate the extent to which people's risk preferences can be explained by SF. Part of their experiment was to test SF versus other decision criteria. These criteria were the Mean-Variance Rule, Second Order Stochastic Dominance, Prospect Theory, and Cumulative Prospect Theory. Because Levy and Levy (2009) review these criteria, we only discuss them briefly here.

[14] If we project strict SF preferences in an EU framework we see that the utility function is not continuous because in SF an individual has a constant utility level above and below the disaster level regardless of the value of x.



Source: Levy and Levy (2009)

The Mean-Variance rule introduced by Markowitz (1952) suggests that the optimal portfolio is the one with the highest expected return and the lowest variance. More specifically, in the case of two portfolios that have the same expected return, investors should pick the one with the lowest variance of return, or in case of two portfolios with the equal variance, investors should select the one with the maximum expected return (mean). If the distribution (of the expected return) is normal, the Markowitz Mean -Variance rule gives the optimal solution in the Expected Utility Framework. However, if the distribution is not normal or additional factors than mean and variance influence preferences then broader decision criteria should be used. Based on Levy and Levy (2009) such criteria are the First Stochastic Dominance (FSD) and the Second Stochastic Dominance (SSD). Hadar and Russell (1969) define FSD and SSD as following:

- The probability function *g* is said to be at least as large as *f* in the sense of FSD if and only if the cumulative distribution $G(x_i)$ is smaller than the cumulative distribution $F(x_i)$ .

$G(x_i) \leq F(x_i)$, for all $x_i \in X$.

This holds anytime that one cumulative distribution is placed entirely, or partly, above the other.

- The probability function *g* is said to be at least as large as *f* in the sense of SSD if and only if the area under one cumulative distribution is equal to, or larger than the area under the other cumulative distribution.

$\int_{x1}^{x} G(y)dy \leq \int_{x1}^{x} F(y)dy$ , for all x ∈ in the closed interval I.

Later, we will show graphically the prospects that dominate based on SSD in Levy's and Levy's study. The last theory that is involved in this study is Prospect Theory

(PT). It was introduced by Kahneman and Tversky (1979) and it asserts that individuals are risk averse with respect to gains and risk – seeking with respect to losses. The extension of PT is the Cumulative Prospect Theory (CTP) (Tversky and Kahneman, 1992). CTP can be applied in continuous distributions, does not violate FSD and allows for different decisions weights for gains and losses instead of equal decision weights for all outcomes (Tversky and Kahneman, 1992). Also, it suggests that individuals decide between uncertain outcomes based on decision weights that are different from the prospects' stated probabilities. The function that links decision weights with stated probabilities is called weighting function.

### 3.2. The EU-SF criterion

As it was explained in the beginning of Section 3, SF decision criterion might lead in paradoxical decisions. In this part, we discuss and prove how the EU-SF criterion, resolves this limitation of SF rule.

Consider to prospects F and G with outcomes x ∈ [α,b] with probability density functions f(x) and g(x).

We normalize the utility function such that U(α)=0 and U(b)=1.

The Expected Utility of each prospect is:

$$E_F U(x) = \int_a^b f(x)U(x)dx \quad and \quad E_G U(x) = \int_\alpha^b g(x)U(x)\,dx$$

If we take the difference Δ between the expected utilities:

$$\Delta = E_F U(x) - E_G U(x) = \int_\alpha^b f(x)U(x) - g(x)U(x)\,dx = \int_\alpha^b [f(x) - g(x)]U(x)dx \quad (1)$$

Integrating by parts and substituting for F(b)=G(b)=1 and F(α)=G(α)=0 we get:

$$\Delta = \int_\alpha^b [G(x) - F(x)]U'(x)dx \quad (2)$$

(2) This holds for any utility function.

Levy and Levy (2009) used the following utility function as example for their analysis:

$$U_{SF}(x) = \begin{cases} U(x) - k, for\ x < d \\ U(x) for\ x \geq d \end{cases} \qquad (3)$$

The greater the k the bigger the divergence from the EU outcome. Stated differently, the greater the k the greater the impact of SF in decisions.

Finding the difference in utility between two prospects (see eq. (1)):

$$E_F U(x) = \int_a^b f(x)U(x)dx - k\int_\alpha^d f(x)\ and\ E_G U(x) = \int_\alpha^b g(x)U(x)\,dx - k\int_\alpha^d g(x)$$

$$\Delta_{SF(x)} = \int_a^b f(x)U(x)dx - k\int_\alpha^d f(x) - \int_\alpha^b g(x)U(x)\,dx + k\int_\alpha^d g(x) =$$

$\int_a^b f(x) - g(x)U(x)dx - k\int_\alpha^d f(x) - g(x)dx$ (4)

Integration of the above integrals yields:

$\Delta_{SF(x)} = \int_a^b [G(x) - F(x)]U'(x)dx + k[G(d) - F(d)]$ (5)

The additional $k[G(d) - F(d)]$ is the impact of SF on decisions.

Based on eq. (5) F is preferred over G if and only if

$\Delta_{SF(x)} = \int_a^b [G(x) - F(x)]U'(x)dx + k[G(d) - F(d)] > 0$,

Dividing both sides by k+1,

$\frac{1}{k+1}\int_a^b [G(x) - F(x)]U'(x)dx + \frac{k}{k+1}[G(d) - F(d)]$,

Setting $\alpha = \frac{k}{k+1}$, and $1 - \alpha = \frac{1}{k+1}$ we obtain the EU-SF criterion:

**Proposition 1:** *For all preference $u \in U_{SF}$ the following holds:*

*F is preferred over G* $\Leftrightarrow$*(1-α)* $\int_a^b [G(x) - F(x)]U'(x)dx + a[G(d) - F(d)] > 0$ *(6) or*

*F is preferred over G* $\Leftrightarrow (1-\alpha)\,[\,E_F U(x) - E_G U(x)] + \alpha[G(d) - F(d)] > 0 \quad (7).$[15]

## 3.3. Tasks that experimentally test the existence of SF preference and its extent.

### 3.3.1. Tasks with equal expected values.

Levy and Levy (2009) experimentally tested the existence of SF preferences with two ways. First, they investigated whether SF preferences matter when participants make decisions. Second, they quantitatively assessed the weight that SF preferences have in decision-making process. Regarding the first objective of their experiment Levy and Levy (2009) designed five tasks where each task had two alternative prospects. The expected values of the two prospects were equal. The key characteristic in the design is that each prospect dominated the other by different decision-making criteria. Below there is a detailed explanation of all five tasks.

Table 1: Experimental Task 1

**TASK 1**

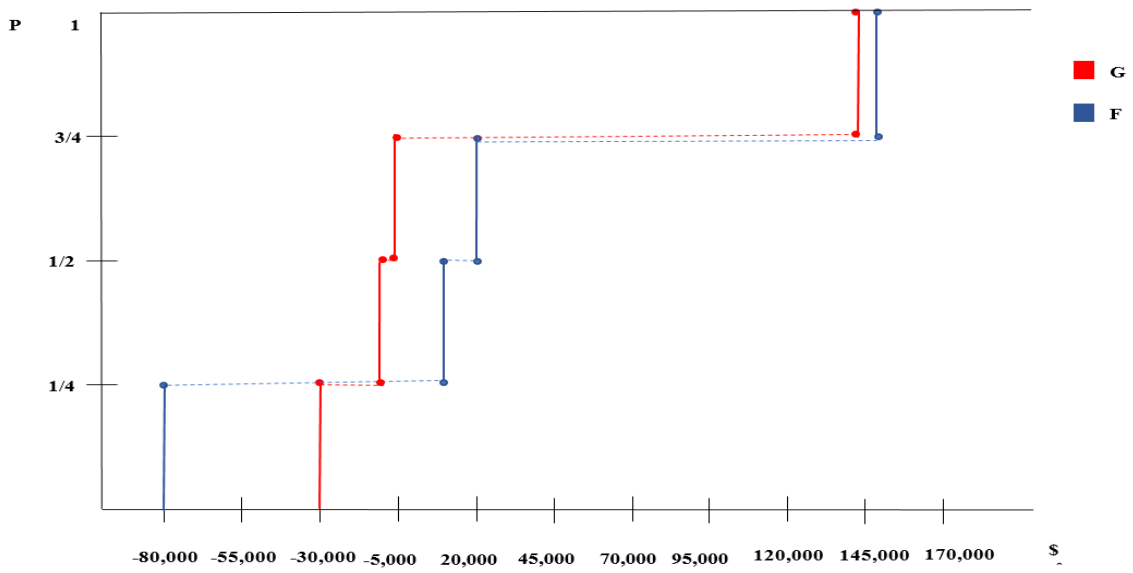
| **F** | **Probability** | **G** | **Probability** |
|---|---|---|---|
| -80,000 | 0.25 | -30,000 | 0.25 |
| 10,000 | 0.25 | -10,000 | 0.25 |
| 20,000 | 0.25 | -5,000 | 0.25 |
| 150,000 | 0.25 | 145,000 | 0.25 |
| | | | |
| Exp Value | 25000 | Exp Value | 25000 |

Table 1 presents task 1 where prospect F dominates prospect G by Safety First Rule because the probability of experiencing a loss is lower (1/4) under F than under G (3/4).

[15] For the properties of EU-SF criterion see Levy and Levy (2009).

The disaster level is assumed to be zero. However, G dominates F by SSD, PT, CPT, and Mean-Variance rule. The SSD of G over F can be easily understood with the following figure.

Figure 10: SSD of F over G in Task 1




In figure 10, the area below the cumulative distribution G is greater than the area under the cumulative distribution F. Stated differently, for a risk averse person, prospect G involves less risk than prospect F. The maximum possible loss under G(-30,000) is lower than the maximum possible loss under F(-80,000). To show the dominance of prospect G over F under PT and CPT, Levy and Levy (2009) used the value function and the parameters estimated by Tversky and Kahneman (1992).

Consider the following value function:

$$\begin{cases} x^{\alpha}, & if\ x \geq 0, \\ -\lambda(-x)^{\beta}, & if\ x < 0 \end{cases} \quad (6)$$

Where x is the monetary outcome of a prospect, α and β are the exponents of the value function and λ is the loss-aversion coefficient.[16] Tversky and Kahneman estimated these parameters as follows: α= β=0.88 and λ=2.25. To show the dominance of Prospect G over prospect F under PT we substitute the parameters and the values of each prospect on the value function (6).

Expected Value under Prospect F:

$EV_F = -2.25(80{,}000^{0.88})\frac{1}{4} + (10{,}000^{0.88})\frac{1}{4} + (20{,}000^{0.88})\frac{1}{4} + (150{,}000^{0.88})\frac{1}{4} =$ - 286.7

$EV_G = -2.25(30{,}000^{0.88})\frac{1}{4} - 2.25(10{,}000^{0.88})\frac{1}{4} - 2.25(5{,}000^{0.88})\frac{1}{4} + (145{,}000^{0.88})\frac{1}{4} = 936.1$

$EV_G(936.1) > EV_F(-286.7)$. Therefore, Prospect G dominates Prospect F under Prospect Theory.

To show the dominance of Prospect G over prospect F under CPT we first calculate the weighting functions. The values of the weighting functions will then replace the objective probabilities in the value function.

$w^+(p) = \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{\frac{1}{\gamma}}}$ for gains, and $w^-(p) = \frac{p^\delta}{(p^\delta + (1-p)^\delta)^{\frac{1}{\delta}}}$ for losses, where p is the cumulative probability, γ and δ are constants that determine the curvature of the weighting functions and has been estimated as 0.61 and 0.69 respectively (Tversky and Kahneman, 1992).

$$w^+(p) = \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{\frac{1}{\gamma}}} \Rightarrow w^+\left(\frac{1}{4}\right) = \frac{\frac{1}{4}^{0.61}}{((\frac{1}{4})^{0.61} + \left(1-\frac{1}{4}\right)^{0.61})^{\frac{1}{0.61}}} \Rightarrow w^+\left(\frac{1}{4}\right) = \frac{0.43}{1.48} = 0.291$$

$$w^-(p) = \frac{p^\delta}{(p^\delta + (1-p)^\delta)^{\frac{1}{\delta}}} \Rightarrow w^-\left(\frac{1}{4}\right) = \frac{\frac{1}{4}^{0.69}}{((\frac{1}{4})^{0.69} + \left(1-\frac{1}{4}\right)^{0.69})^{\frac{1}{0.69}}} \Rightarrow w^-\left(\frac{1}{4}\right) = \frac{0.38}{1.38} = 0.294$$

[16] "λ>1 indicates how much a $1 loss is overweighed than $1 gain" (Levy and Levy, 2009).

$EV_F = -2.25(80{,}000^{0.88})0.294 + (10{,}000^{0.88})0.291 + (20{,}000^{0.88})0.291 + +(150{,}000^{0.88})0.291$=-462.3

$EV_G = -2.25(30{,}000^{0.88})0.294 - 2.25(10{,}000^{0.88})0.294 - 2.25(5{,}000^{0.88})0.294$+ +$(145{,}000^{0.88})0.291$ = =1002.4

$$EV_G(1002.4) > EV_F(-462.3).$$

Therefore, Prospect G dominates Prospect F under Cumulative Prospect Theory. Finally, to show the dominance of Prospect over F under the Mean-Variance rule we only need to compare the variances of the two prospects since the mean values are the same ($\mu_F = \mu_G = 25{,}000$).

$\sigma_F = 82{,}006$ $and$ $\sigma_G = 69{,}911$. Since $\sigma_G < \sigma_F$ prospect G dominates prospect F under Mean-Variance Rule.

For the rest four we followed the same process and we provide the values of each prospect under each decision theory.

Table 2: Experimental Task 2

**TASK 2**

| **F** | **Probability** | **G** | **Probability** |
|---|---|---|---|
| -10,000 | 0.20 | -40,000 | 0.2 |
| -8,000 | 0.20 | 1,000 | 0.2 |
| -7,000 | 0.20 | 2,000 | 0.2 |
| -6,000 | 0.20 | 5,000 | 0.2 |
| 60,000 | 0.20 | 61,000 | 0.2 |
| Exp Value | 5800 | Exp Valule | 5800 |

In task 2 (table 2), Prospect G dominates Prospect F by Safety First Rule because the probability of experiencing a loss is lower (1/5) under G than under F of (4/5).

Additionally, F dominates G by SSD, and Mean-Variance rule. The SSD of F over G is shown in figure 11.[17]

Figure 11: SSD F over G in Task 2

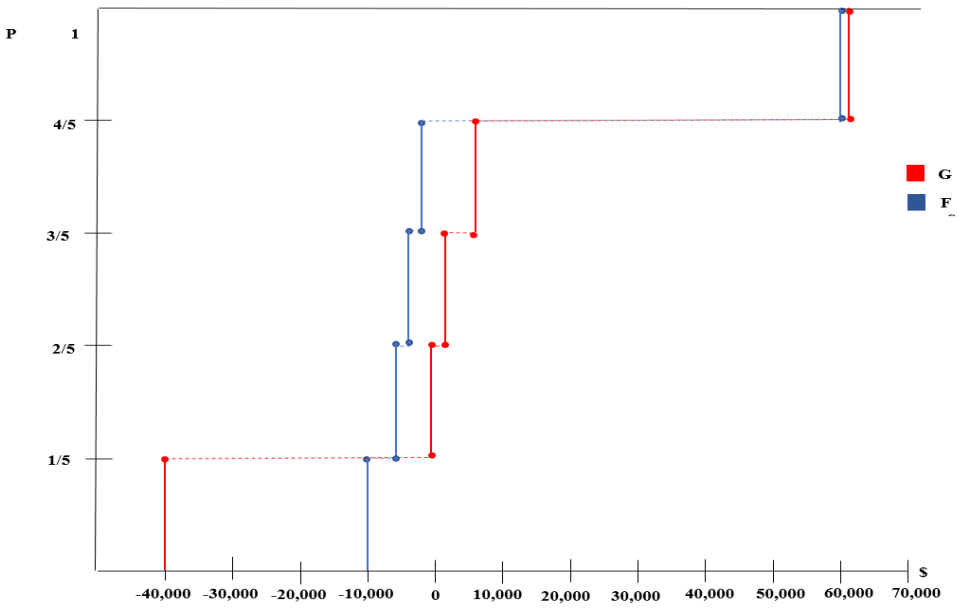



Table 3: Experimental Task 3

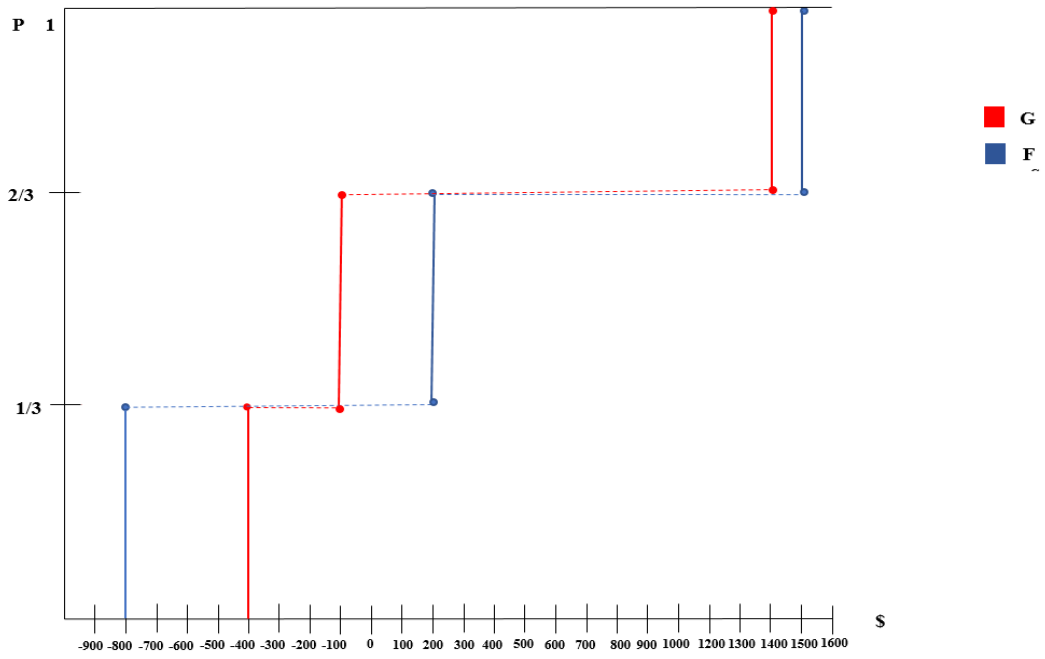
| TASK 3 | | | |
|---|---|---|---|
| **F** | **Probability** | **G** | **Probability** |
| -800 | 0.33 | -400 | 0.33 |
| 200 | 0.33 | -100 | 0.33 |
| 1,500 | 0.33 | 1,400 | 0.33 |
| Exp Value | 297 | Exp Value | 297 |

In task 3 (table 3), Prospect F dominates Prospect G by Safety First Rule because the probability of experiencing a loss is lower (1/3) under G than under F of (2/3).

[17] Since F second-order stochastically dominates G, F dominates by Mean-Variance rule as well (Levy and Levy, 2009)

Additionally, G dominates F by SSD, PT, CPT, and Mean-Variance rule. The SSD of G over F is shown in figure 12.

Figure 12: SSD G over F in Task 3




Expected Values of Task 3 under PT:

$EV_F$ = -25.56 < $EV_G$ = 6.24

Expected Values of Task 3 under CPT:

$w^+\left(\frac{1}{3}\right) = 0.33$ and $w^-\left(\frac{1}{3}\right) = 0.35$

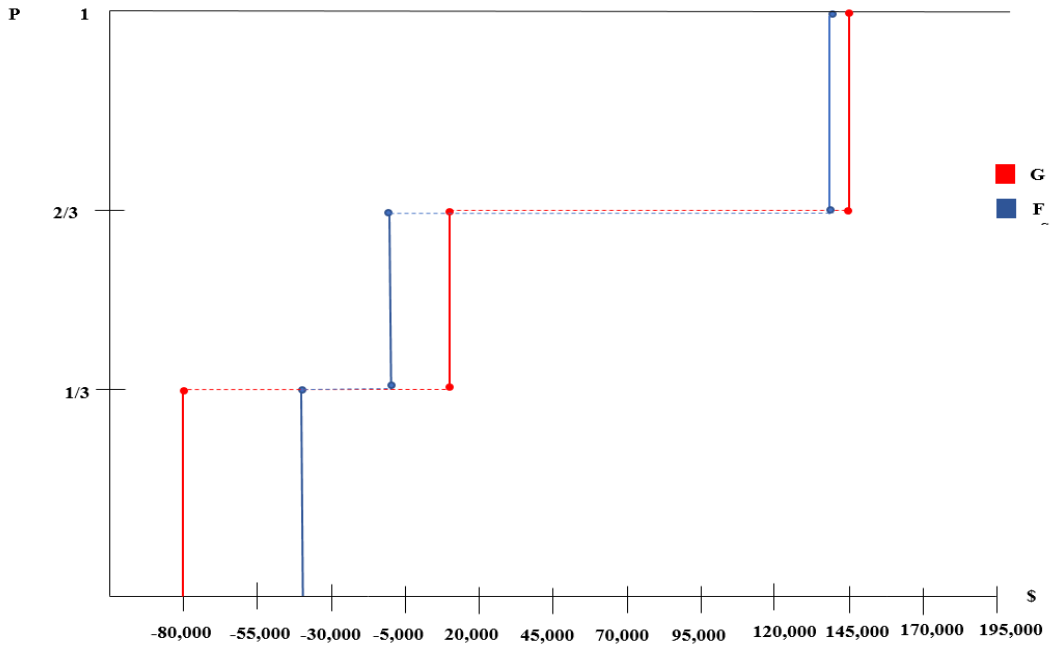
$EV_F$ = -39 < $EV_G$ = -2.9

Table 4: Experimental Task 4

| TASK 4 | | | |
|---|---|---|---|
| **F** | **Probability** | **G** | **Probability** |
| -40,000 | 0.33 | -80,000 | 0.33 |
| -10,000 | 0.33 | 20,000 | 0.33 |
| 140,000 | 0.33 | 150,000 | 0.33 |
| Exp Value | 29700 | Exp Value | 29700 |

In task 4 (table 4), Prospect G dominates Prospect F by Safety First Rule because the probability of experiencing a loss is lower (1/3) under G than under F of (2/3). Also, F dominates G by SSD, PT, CPT, and Mean-Variance rule. The SSD of G over F is shown in figure 13.

Figure 13: SSD F over G in Task 4




Expected Values of Task 4 under PT:

$EV_F = 360 > EV_G = -1{,}471$

Expected Values of Task 4 under CPT:

$EV_F = -166.82 > EV_G = -2244.5$

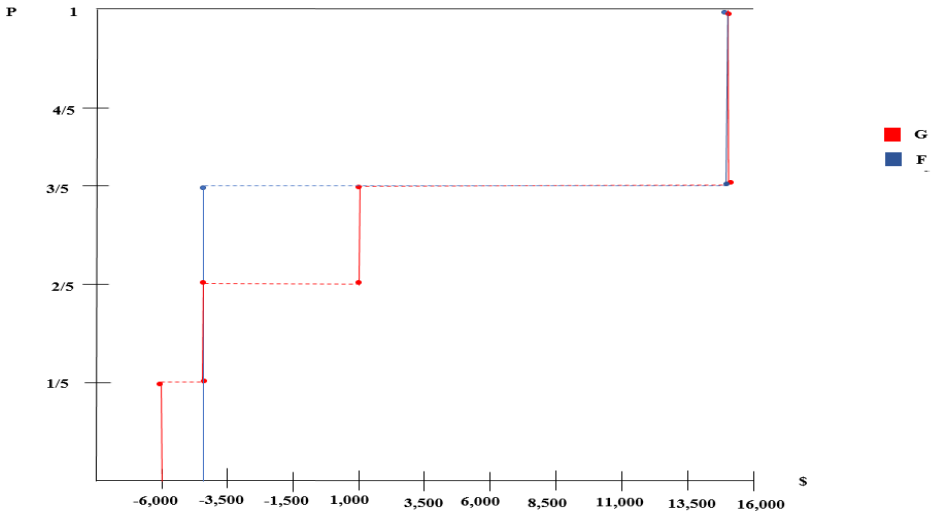
Table 5: Experimental Task 5

**TASK 5**

| **F** | **Probability** | **G** | **Probability** |
|---|---|---|---|
| | | -6,000 | 0.2 |
| -2,500 | 0.6 | -2,500 | 0.2 |
| 15,000 | 0.4 | 1,000 | 0.2 |
| | | 15,000 | 0.4 |
| | | | |
| Exp Value | 4500 | Exp Value | 4500 |

In task 5 (table 5), Prospect G dominates Prospect F by Safety First Rule because the probability of experiencing a loss is lower (2/5) under G than under F of (3/5). Additionally, F dominates G by SSD, PT, CPT, Mean-Variance rule, and the "number of minus signs" criterion. The SSD of G over F is shown in figure 14.

Figure 14: SSD F over G in Task 5



Expected Values of Task 5 under PT:

$EV_F = 2479 > EV_G = 589$

Expected Values of Task 5 under CPT:

$EV_F = 610.95 > EV_G = 77.44$

**3.3.2. Tasks for assessing the relative weight of SF in decisions**

The second part of the Levy and Levy (2009) experiment involved two tasks, where each task had two alternative prospects. One prospect dominated by SF as before. However, the other prospect had the last possible outcome blank. Participants were asked to state the value that would make them indifferent between the two prospects. The magnitude of this value determined how much (if any) weight each participant places in SF.

Table 6: Experimental Task 6

**TASK 6**

| **F** | | **G** | |
|---|---|---|---|
| -12,000 | 0.33 | -8,000 | 0.33 |
| 2,000 | 0.33 | -2,000 | 0.33 |
| 30,000 | 0.33 | X | 0.33 |

Prospect F dominates Prospect G by SF. If x=30,000 then the two prospects yield equal mean value. For x=30,000 a risk-averse person would prefer G over F since the possible loss is smaller over G(-10,000) than over F(-12,000). A value higher than 30,000 implies that individuals place value to SF.[18] That is, the higher the value they state the higher the amount that is required to offset the increased probability (of prospect G) to

[18] For values of X lower than 30,000 we assume absence of SF preferences and therefore α=0.

experience a loss. As Levy and Levy (2009) state "The more the subjects care about SF, the higher X should be (everything else equal)." Task 7 allowed the authors to get a second independent estimate of α for the same individual for different probabilities and outcomes. In this case, the two prospects are equal when x=54,000.

Table 7: Experimental Task 7

**TASK 7**

| **F** | **Probability** | **G** | **Probability** |
|---|---|---|---|
| -12,000 | 0.25 | -26,000 | 0.25 |
| -5,000 | 0.25 | 3,000 | 0.25 |
| 1,000 | 0.25 | 4,000 | 0.25 |
| X | 0.25 | 55,000 | 0.25 |

It is useful to explain how the values provided by participants in task 6 and task 7 were converted to relative weight of SF in decisions, since we calculated that weight for our sample as well.

**Task 6**

Consider the following utility function:

U(x)= Ax+B, (A>0)

We normalize the utility function, as we did when we derived the SF-EU condition (see Section 3.2.), such as U(-12,000)=0 and U(X)=1.

By solving for A and B we get:

A = $\frac{1}{X+12{,}000}$ and B = $\frac{12{,}000}{X+12{,}000}$

Therefore $E_F U(x) = \frac{1}{3}\left(\frac{-12{,}000}{X+12{,}000}\right) + \frac{1}{3}\left(\frac{2{,}000}{X+12{,}000}\right) + \frac{1}{3}\left(\frac{30{,}000}{X+12{,}000}\right)$ and

$E_G U(x) = \frac{1}{3}\left(\frac{-8{,}000}{X+12{,}000}\right) + \frac{1}{3}\left(\frac{-2{,}000}{X+12{,}000}\right) + \frac{1}{3}\left(\frac{X}{X+12{,}000}\right)$

Consider the necessary condition of SF-EU preferences:

(1-α) [ $E_F U(x) - E_G U(x)$] + $a[G(d) - F(d)] > 0$ $\left(see\ eq.(7)\right)$.

For a person to be indifferent between the 2 prospects we need to change the inequality to equality. By substituting $E_F U(x)\ and\ E_G U(x)$ into the indifference condition becomes:

(1-α) $\frac{1}{3}$ [$\left(\frac{-12{,}000+2{,}000+30{,}000+8{,}000+2{,}000-X}{X+12{,}000}\right)$ + α ($\frac{2}{3} - \frac{1}{3}$) = 0.

By solving for α:

α= $\frac{X-30{,}000}{2X-18{,}000}$ (8), where X is individual's answer in task 6.

Hence, eq. 8 gives the relative weight of SF in decision for any individual.

**Task 7**

The process is the same for task 7. For preferences expressed from a utility function of the form: U(x)= Ax+B, (A>0), the relative weight of SF for task 7 is: α= $\frac{X-54{,}000}{3X-2{,}000}$.[19]

Some general comments about Levy's and Levy's (2009) experimental design. First, they tested the existence of SF preferences in a broad range of monetary units (e.g. hundreds of dollars, tens of thousands, and hundreds of thousands). Second, they controlled for the side that the SF outcome was in each task (e.g. in task 1 SF outcome was on left-hand side, in task 2 it was on the right-hand side etc.). However, they provided economic incentives for only one out of five tasks of the first part. This is something that we tried to address in our study by converting Experimental Currency Units (ECUs) into

[19] Levy and Levy estimated α with other utility functions. They didn't find α to be sensitive under different preferences.

real dollars instead of directly using real dollars. In Section 4, there is a detailed discussion about subjects' compensation.

# 4. Experimental Design

The advantage of using laboratory experimental methods in economics is that they allow for examination of an individuals' specific behavior holding everything else constant (Levitt and List, 2007). This would be hard to be examined with an alternative method (Levitt and List, 2007). In a lab experiment, the researcher is able to change the parameter of interest (set of prices, information set etc.) and observe the effect of this change (Levitt and List, 2007). Experiments, generally are subject of criticism in the sense that a human behavior produced in the lab may not be alike with the behavior in real world. Although lab experiments may not result in an accurate quantitative answer, their qualitative findings are likely to be relevant to what one would observe outside of the lab (Levitt and List, 2007). Due to the difficulty of collecting primary data on marketing behavior from a random sample, we believe that a lab experimental approach was appropriate for this study. Even if our results may not be quantitatively precise, they may closely approximate actual marketing decisions compared to theoretical studies on marketing.

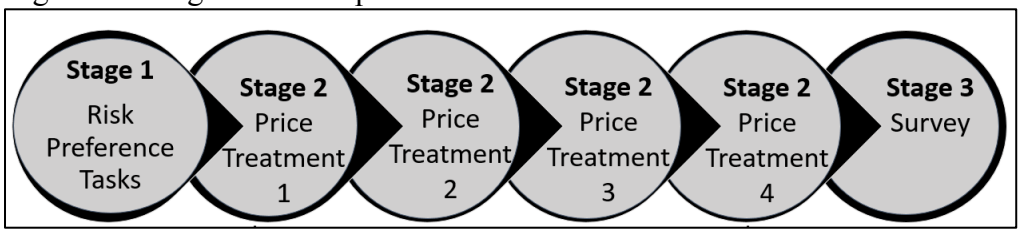
## 4.1. Within-Subject design

To meet the objectives of this study we designed a 3-stage within-subject context-rich experiment (See figure 15). In a within-subject design, subjects participate sequentially in more than one treatments (Charness, Gneezy and Kuhn, 2012). This experimental design allowed us to test the behavior of the same subject under different market conditions, after controlling for her risk preferences. The main advantage of a within-subject design is its relevance to many theoretical concepts (Charness, Gneezy and

Kuhn, 2012). For example, usually experimenters are more interested in observing the change in the behavior of the same subject, as a response to a change of a given condition (communication vs no communication), than observing different individuals under different conditions. This reduces subject variability as the subject is its own control. As Wag, Wang, and Gong (2009) say, in this design "the subject serves as his own matched control". However, the within-subject design is more likely to suffer from Experimenter Demand Effects (EDE) (Charness, Gneezy and Kuhn, 2012). Later we explain how we tackled this issue.

The alternative of within-subject design is the between-subject design. In this case, the experimenter randomly splits participants into sub-samples and each sub-sample is exposed to one treatment only. Between-subject designs yield to more conservative tests and therefore tend to be more desirable to experimenters (Charness, Gneezy and Kuhn, 2012). However, the context of the study is important when it comes to design decisions (Charness, Gneezy and Kuhn, 2012). The way that grain marketing functions is closer to within-subject design since producers face grain marketing years sequentially and each year is different than the previous.

Figure 15: Stages of the Experiment




### 4.2. Subject Pool

In this study, the experimental subjects were undergraduate and graduate students from the University of Nebraska in Lincoln as well as from the Nebraska College of

Technical Agriculture in Curtis. The latter is a 2 years college where students are being specialized in areas related to grain production and animal production. A common question that is asked when an experiment is conducted with convenience samples is whether the results would be the same if the sample was drawn from a heterogeneous population (Druckman and Kam, 2011). Stated differently, there is a concern that student samples reduce the external validity of an experiment. Druckman and Kam (2011) argued that it is acceptable to run an experiment with students if there is no prior work in this area. Since this experiment is part of an exploratory research we believe that the use of student sample is not problematic. If prior work in this research area existed, then a heterogeneous sample would contribute more to the literature than the student sample. Additionally, in this study we are mostly interested in detecting behaviors that are "conceptually equivalent" (Anderson and Bushman, 1997) to what we would detect in real world (Druckman and Kam, 2011). That is, we expect our results to be qualitatively and not quantitively similar to reality. Of course, we should not forget that grain marketing is a specialized topic and there is a plausible concern that a student sample may empirically differ from the population. By recruiting students from both campuses, we created a random sample which included both experienced and unexperienced subjects in farming and grain marketing. Nevertheless, a repetition of this study with producers is an important extension.

### 4.3. Description of the simulation game

As it is depicted in the flowchart, in stage 1 subjects completed the seven tasks designed by Levy and Levy (2009). Since an analytical description of all seven tasks has been provided in Section 3, here we will directly discuss Stage 2. In stage 2, participants were asked to participate in a grain marketing simulation game. This game is called

Marketing in a New Era (MINE) and its initial purpose was to serve as a learning tool in grain marketing extension meetings in Nebraska.[20] We analytically discuss its functions and its contribution to Nebraska producers in Chapter 1. In this section, we will only mention the key attributes of this simulation that led us to incorporate it into the experimental design of the study. The MINE simulation game provides users a platform representing producers' grain marketing environment. As in any simulation game, concessions must be made between the game and the real world. MINE provides users the opportunity to sell grain at pre-determined decision points. At each decision point, the user can execute cash, futures and basis contracts for any amount of grain. MINE can be simplified to focus on certain objectives by limiting the contract type. In the experiment, we focused only on cash contracts.[21] Figures 16 and 17 show the contract types under the original and the simplified version of MINE respectively.

[20] The website of the Marketing in a New Era simulation is mine.unl.edu

[21] This study focuses on contracts for spot delivery and contracts for futures delivery. We will not elaborate on futures contracts, basis contracts, hedge to arrive contracts, options etc. because their analysis goes beyond the purposes of this study. Also, we cover only short hedging (selling grain with futures contracts) and not long hedging (buying grain with futures contracts).

Figure 16: Decision Screen with cash, futures and basis contracts


Figure 17: Simplified Decision Screen


We used the simplified version of MINE (figure 17) because it allows to work with subjects that were not necessarily familiar with the grain marketing process without

discounting the research objectives. The yellow boxes in the "cash" column include corn prices that the user could lock at. The first price in this column is the price offered in the spot market for immediate delivery and therefore there is no storage cost associated with it. The remaining prices are prices for futures delivery. This means that the subject will receive the price she locked minus the storage cost that is associated with the respective month. For example, a contract created in October for December delivery at the price of 4.2 ECUs (see figure 17) means that the user will receive 4.2 ECUs no matter what the spot price will be in December. However, she will pay a storage cost for keeping the grain stored for 2 months.

Another important feature of MINE game is the way that futures and cash corn prices are portrayed in today's price environment. MINE contains actual prices that have been previously experienced going back to the early 1990.[22] However, these prices do not reflect today's prices. In order to link the historical price series and the current prices MINE starts with an administrator defined current price, called the initial price. Each historical price series is converted into a percent change in price from one day to the next. The initial price is the input that creates the new price series based on the historical percent change price series. This feature was crucial for our study because it allowed us to create various price treatments and to test behavior under actual market conditions without intervening in price series' patterns.

[22] This data is available in CME group website (https://www.cmegroup.com/).

### 4.4. Price Treatments

Our study involved four different price treatments. Each treatment represented a different marketing year and hence, a different market environment. Participants did not receive any prior information about market environment. We did emphasize in the instructions that the prices observed were not related in any way to other treatments' prices or to subjects' performance in previous treatments. The four price treatments were selected by finding years with specific price characteristics. In Treatment 1 (hereafter "Stable" Price Series or T1) the prices did not change drastically as the marketing year evolved. The purpose of this treatment was to test what are the behavioral characteristics of the subjects who chose to sell later in the year even though spot prices did not differ substantially. Other price series provided larger changes in prices throughout the marketing year. The price series used for T1 came from the 1992 marketing year, Figure 18. T1 provided carry opportunities (See Table 8). In Treatment 2 (hereafter Decreasing Price Series or T2), prices were decreased from month to month compared to 4 ECUs October's spot price (cash price at harvest) and used 2002 marketing year, Figure 19. In addition, T2 had zero carry opportunities (see table 8). Treatment 3 (hereafter Erratic Price Series or T3), did not have a specific (increasing or decreasing pattern) throughout the marketing year but prices did fluctuate. That is, prices were increasing in one month and decreasing the next month. T3 used 2003 marketing year prices, Figure 20. Finally, in Treatment 4 (hereafter increasing price series or T4) prices were increasing from month to month. This price series had the highest net price of all treatments and its lowest price did not fall below production cost (3.8). In T4 used 2006 prices, Figure 21.

Table 8: Overview of Price Treatments

| Price Treatment | Maximum Price after Storage Cost | Minimum Price after Storage Cost | Average Price after Storage Cost | Average Spot Price* | Carry Opportunities ** |
|---|---|---|---|---|---|
| T1 "Stable" Price Series | 4.6 | 3.5 | 3.75 | 4.15 | 8 |
| T2 Decreasing Price Series | 4 | 2.5 | 3.27 | 3.66 | 0 |
| T3 Erratic Price Series | 5.41 | 3.2 | 4.3 | 4.77 | 3 |
| T4 Increasing Price Series | 6.41 | 3.88 | 5.25 | 5.68 | 8 |
| Average | 5.15 | 3.27 | 4.14 | 4.56 | 4.75 |

*Price at harvest was 4 ECUs for all price treatments except 2003's where the harvest price was 4.1 ECUs.
** As carry opportunity we define the highest positive return to storage for a specific decision point (month). A carry opportunity is essentially the "reward" that the market gives to producers to keep the grain stored instead of selling it at the spot market.

Figure 18: Price Treatment 1, "Stable" Price Series

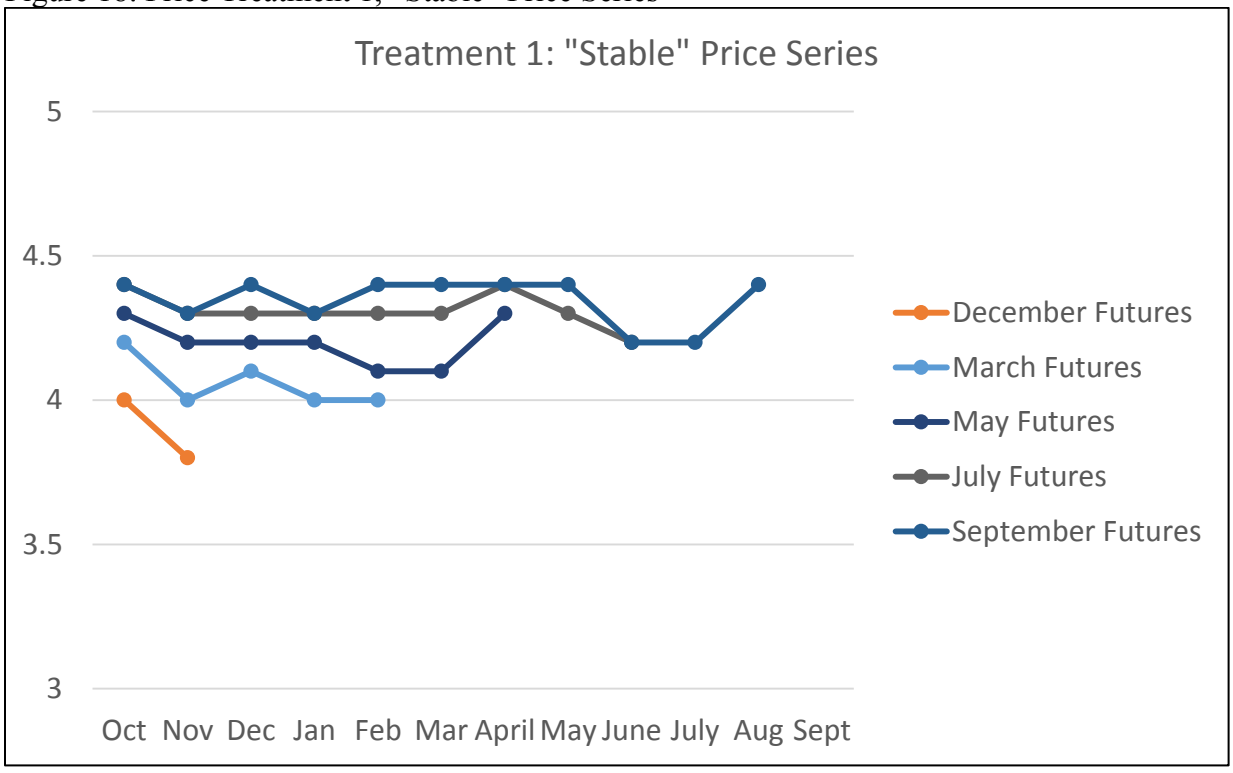


Figure 19: Price Treatment 2, Declining Price Series

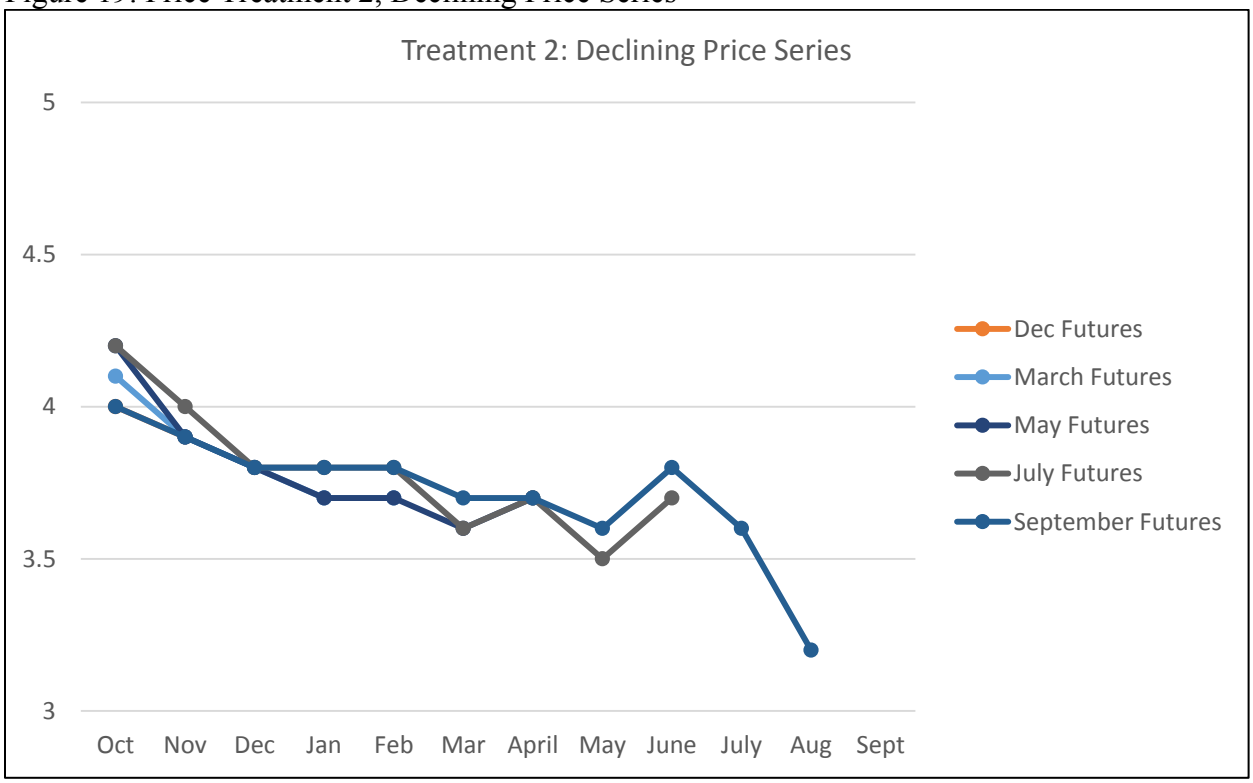



Figure 20: Price Treatment 3, Erratic Price Series

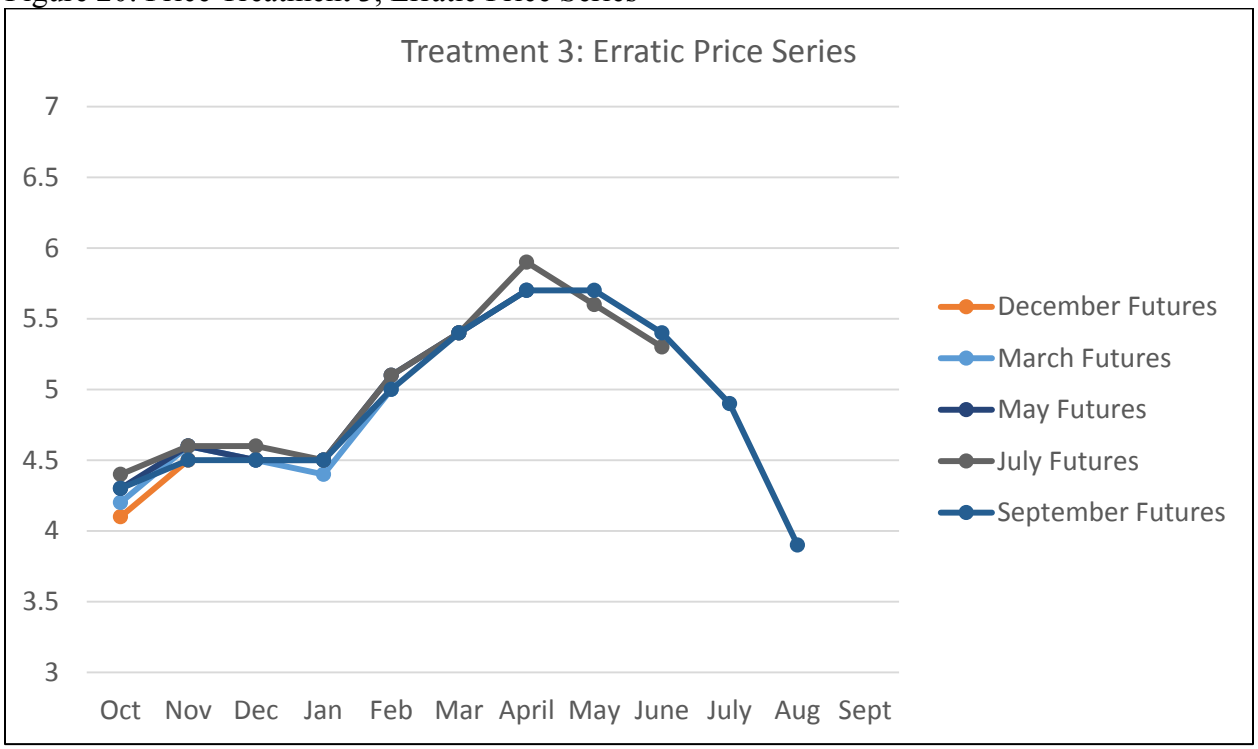
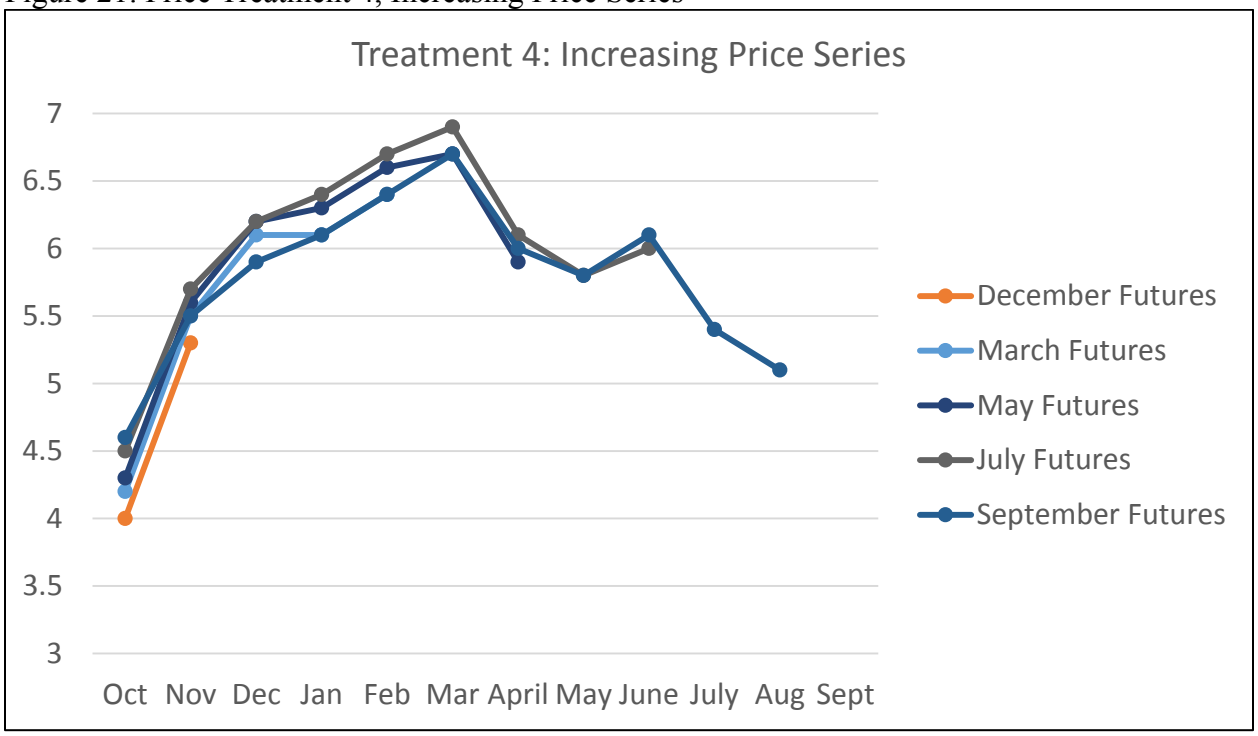


Figure 21: Price Treatment 4, Increasing Price Series




### 4.5. Other important elements of the experimental design in Stage 2

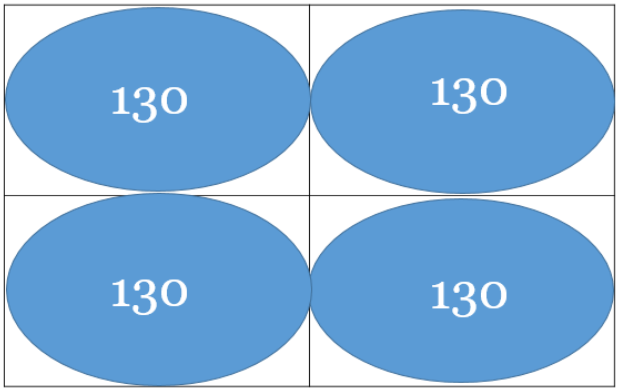
Up to now, it should be clear that a context-rich experiment was necessary in this study because it involved a realistic grain marketing environment while maintaining the benefits of a controlled lab environment. To increase the relevance of the study to real world decisions, besides the price treatments, we incorporated the following additional elements of corn production in Nebraska:

1) Amount of Bushels to Be Sold

At the beginning of each marketing year subjects had 117,500 bushels available to sell in each treatment. We arrived at this number through a producer operating on 640 acres with 520 being irrigated (Figure 22). Each irrigated acre an actual yield of 225

bushels per acre for a total of 117,000 bushels (520 acres *225 bushels per acre).[23] Grain was not allowed to be carried over from one year to the next, so all grain was sold at the end of the simulation. Instructions to participants made it clear that any unsold bushels at the end of the simulation would be automatically sold by the computer.

Figure 22: Full Section of an irrigated crop




2) Production Cost and Storage Cost

We calculated production and storage costs using the 2015 Nebraska crop budgets for irrigated corn after soybeans. Estimated production cost was $4.15. We reduced this amount to $3.80 by removing the any expenses related to storage cost (dry grain etc.) because the storage cost we used in the experiment was inflated. That is, we set a storage cost at 7 cents per bushel per month. This rate was set by identifying commercial storage facilities while adding a bit more to ensure the cost was high enough for participants to notice.[24] These changes facilitated the experimental design aspect of the study without discounting its qualitative outcome. In general, the production cost was fixed (446,500 ECUs) for all participants and under all treatments and it was deducted at the end of each

[23] These figures are based on 2015 Nebraska crop budgets (http://cropwatch.unl.edu/budgets). 500 bushels were added to the total due to the MINE software providing bushels to be sold on 2,500 bushel increments.
[24] It is common that even producers tend to ignore some or all of their storage cost. Other grain marketing simulation games as the Commodity Challenge from the University of Minnesota (https://commoditychallenge.com) have set a storage cost at 5 cents per bushel per month for the same reason.

year from subjects' earnings. The storage cost varied based on subjects' marketing decisions. The only marketing period price with a zero storage cost was the spot price in the first month, October. The storage cost was deducted at the end of each month according to the quantity in storage. The experimenter informed participants regarding the values of production cost and storage cost and regarding the way that they will be deducted from their earnings (See Instructions in the Appendix). All costs were the same for all subjects and under all treatments. This way, no one had a lower cost advantage that could affect her decisions of selling or storing grain. Finally, participants received feedback about the costs at the end of each month and at the end of each year. Similarly, with the amount of grain, future research can study the change in behavior under different levels of production or storage cost.

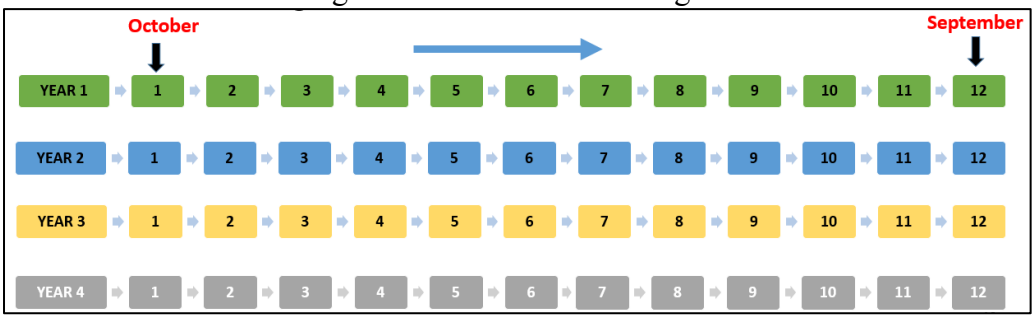
3) Timeline

Stage 2 contained 4 periods (marketing years) with 12 rounds (months) per period (see figure 23). The timeline was always available to subjects on the top of the MINE screen, allowing them to see in what round (month) they are in (see figure 17). October was the first month in post-harvest marketing because this is the time that corn harvest is taking place in Nebraska (USDA Agricultural Handbook Number 628, 1997). One may argue that 12 pricing opportunities are too few since in reality, each day is potentially a pricing opportunity, or too many since there is evidence that corn producers market their grain 3.95 times per marketing year (Goodwin and Kastens, 1996).[25] Our decision to

[25] This figure includes both pre-harvest and post-harvest marketing decisions.

involve 12 decision points was based on the fact that a considerably large number of decision points would allow participants plenty of opportunities to market grain.

Figure 23: Flow Chart of Stage 2




4) Amount of grain sold per contract

Subjects sold in 5,000 bushel increments, which is the standard futures contract amount. To facilitate the flow of the experiment we created units of 10,000, 15,000, 20,000, 25,000 bushels (see figure 24). This way subjects could create a contract greater than 5,000 at once without having to create multiple contracts of 5,000 bushels. Regarding the maximum amount sold at each price there was no restriction imposed. That is, subjects controlled the amount they wanted to sell at each price. They could even sell the entire amount of their grain at one price if they wanted to. In future experiments, it would be interesting to remove the units and let subjects type the exact amount they would like to sell.

Figure 24: Units of grain that subjects could select


5) Instructions and Prior Information

Instructions in a context-rich experiment are challenging. The experimenter should introduce a context to participants that may be completely new to them in a simple way without influencing their behavior in any way. To effectively communicate the context of our experiment we presented the instructions in a novel way. Instead of reading loudly a long document, we created a presentation with animations and screenshots from the experimental interface which made the instructions' clearer. We piloted both the traditional method of reading the instructions and the new method of presenting them before we concluded that presentation was more efficient method in terms of understanding and in terms of timing.[26] Subjects were provided with a copy of presentation's slides as well as with scratch paper in case they wanted to keep notes.

Since a complete copy of the instructions' slides is included in the Appendix, here we will only provide the list with the features of Stage 2 that they were known to participants before the beginning of the experiment (see table 9).

[26] At the end of the experiment we asked participants whether the instructions were clear, to verify that the introduction of the marketing context did not confuse them. 90% of the subjects did not have any difficulty to understand the instructions.

Table 9: Information Provided to Subjects

| Information Piece | Value | Variable or Fixed Across Years |
|---|---|---|
| Grain Endowment | 117,500 bushels | Fixed |
| Production Cost | 3.8 ECUs/bushel 446,500 | Fixed |
| Storage Cost | 0.07 ECUs/ bushel/month | Variable |
| Number of periods | 4 sequential periods (years) | Fixed |
| Number of rounds | 48 rounds (12 sequential rounds per period) | Fixed |

6) Information Feedback

Subjects received feedback about the amount of grain they have sold, the earnings and the costs at the end of every month. The feedback on the number of bushels sold was provided through a graph on the right side of the decision screen (see figure 25). Every time that the subject created a contract, the percentage of grain sold changed and the level of the brown area in the graph rose. Also, this graph informed participants about the initial amount of grain as well as about the amount of grain that was left to be sold. In addition, participants were receiving feedback on a monthly basis regarding the earnings and the storage cost. Figure 26 shows the feedback received at the end of each month. Subjects could review the sales (price they selected to sell at multiplied by the quantity they indicated) and the storage cost they have incurred up to this month.[27] The computer automatically calculated subjects' monthly earnings by subtracting the storage cost from the sales.[28]

[27] Storage cost until the next month includes the storage cost of the unsold amount that is transferred to the next month as well as the storage cost of any futures contract that expires in later month.

[28] Due to software limitations, we could not subtract production cost from sales in a monthly basis. Therefore, we subtracted at once, at the end of the year. Participants were aware that the production cost will not be deducted from their earnings before the end of the year.

Finally, at the end of each year participants were receiving feedback about the final earnings, the production cost and the total storage cost they incurred throughout the year. Figure 27 is an example of the summary screen that was provided at the end of the year. On the left side of the screen all sales and storage expenses are listed in descending order starting from the most recent incident (charge or sale). On the right side of the screen earnings for that year are presented. The total sales are the sum of all sales that executed throughout the year. The production cost and the total storage cost is subtracted from the total sales and results in the earnings in ECUs for the specific year. The sum of the earnings of all four years was the basis for subject' payment for Stage 2 at the end of the experiment. The year's summary table followed an overview of all four years (see figure 28) that showed what were the earnings in completed years and how many years are left until the conclusion of Stage 2.

Figure 25: Feedback regarding the amount of grain sold

Figure 26: Feedback at the end of the month

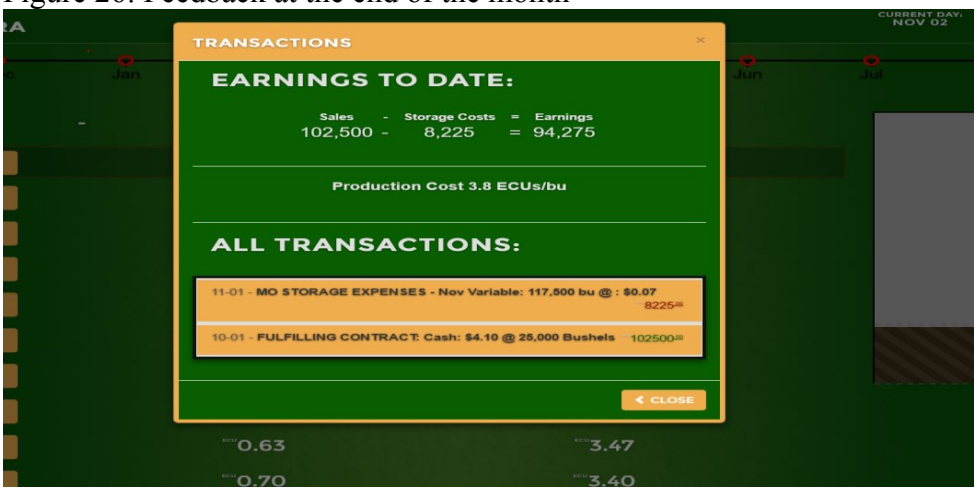



Figure 27: Feedback at the end of the marketing year


Figure 28: Feedback on the progress made in Stage 2

7) Practice period

There was a practice period before subjects participated in Stage 2.[29] Participants, along with the experimenter went through the first two months. The experimenter had an opportunity to repeat and show in practice how the software works. Then, the experimenter asked participants to complete by themselves the practice period and she replied to questions in person. The price series used in the practice period was different from the price series used in the treatments. However, all other features (costs, number of decision points etc.) were exactly the same as in the actual years.

8) Order Effects

Order effect is one of the Experimenter Demand Effects (EDE) (Zizzo, 2008). [30] More specifically is a Purely Cognitive EDE that may cause confounding in within-subject experiments. Simply stated, experimental subjects try to understand a context which is not familiar to them. To do so, they abstract information from instructions, cues and feedback (Zizzo, 2008). The order that the tasks are presented to subjects is a potential source of Purely Cognitive EDE, if subjects believe that they understood the objectives of the experiment because of the order they participated in the tasks (Zizzo, 2008). In this case, subjects adjust their behavior based on their perceptions about what the objectives are and they do not exhibit the same behavior as if the tasks were presented separately (Zizzo, 2008).

[29] In Stage 1, we asked participants to complete a quick quiz to check their understanding.
[30] "Experimenter demand effects (EDE for short) refer to changes in behavior by experimental subjects due to cues about what constitutes appropriate behavior (behavior 'demanded' from them)." Zizzo, 2008).

A typical way to address this issue and to maintain experimental control is to counterbalance or to randomize the order of the treatments. In our study, all subjects participated in all treatments, and therefore a control for order effects was necessary. The number of possible combinations of the four treatments equals to 4! (24 different combinations). Budget and time constraints make impossible the implementation of all 24 combinations. In this case, the experiment would require a very large number of experimental units in order to detect significant differences, and also, the budget and the time of data collection would be hiked up. For this reason, we used the Latin Square Design. In this design, each treatment is represented only once at each row and each column. This way each treatment is uniformly represented both within periods and within sequences (Wang, Wang, and Gong, 2009). The treatment sequences we used are presented in the following table:

Table 10: Treatment Sequences Used

| Treatment Sequence \ Period | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **1** | T1 | T2 | T3 | T4 |
| **2** | T4 | T1 | T2 | T3 |
| **3** | T2 | T3 | T4 | T1 |
| **4** | T3 | T4 | T1 | T2 |

9) Payment

One of the most interesting tasks of the experimental design of this study was subjects' payment. Levy and Levy (2009) introduced payment only for 1 of the tasks and only for one participant who would be picked at random. In their study, they stated that

monetary incentives are important and that the results of the task that involved the potential of a payment were even more significant (Levy and Levy, 2009). From the other hand, it is difficult to incentivize properly an experiment that involves high positive and negative values when you pay directly in cash. Even if we assume that there is no resource scarcity for the experimenter and that she could afford a payment of $150,000, it is obvious that no one would participate in an experiment that she may be asked to pay $80,000. The fact that the values in our experiment were tens of thousands and even hundreds of thousands of dollars for both in Stage 1 and Stage 2 provides sufficient design motivation for using Experimental Currency Units (Davis and Holt, 1993; Drichoutis, Lusk, Nayga, 2015). The payment happened as follows. At the end of the experiment we were asking from a participant to pick a card from a shuffled deck of 5 cards. Each card represented one of the first five tasks in Stage 1.[31] Once a task from 1 up to 5 was picked, another card was drawn in order to determine which outcome will be used for subjects' payment. The number of cards varied depending on the number of outcomes that the selected task had.

For example, the first task had 3 possible outcomes, so the subject had to choose between 3 cards. The outcome of the Stage 1 (either negative or positive) was then added to the earnings from Stage 2. The earnings in Stage 2 were the sum of the earnings in all four games. Once earnings from Stage 1 and Stage 2 in ECUs were added up, we converted them to real dollars at an exchange rate of $1 per 12,611 ECUs. After piloting the experiment with more than 20 individuals we realized that based on the average earnings

[31] We did not provide monetary incentives for the last 2 tasks in Stage 1, because the potential of a payment would encourage subjects to state a higher value than their actual preference. Even though there are payment methods that address these sort of issues, that would require more time spent in instructions and would complicate further the experiment. Therefore, we excluded the last 2 tasks of Stage 1 from the payment process.

from stage 2, and an additional flat show-up fee of $7, even if the payment from Stage 1 was negative, it was unlikely that someone earn less than $7. On average participants earned $22.1, with a standard deviation of $6.82, a minimum of $7 and a maximum of $40.

### 4.6. Stage 3: Survey

After completing Stage 2, subjects were asked to participate in a socio-demographic survey (see Appendix). The survey had three main sections that each of them controlled respectively for i) familiarity with the concept of Expected Value and probability theory ii) typical demographic characteristics as age, gender, field of major studies etc., and iii) familiarity with farming and grain marketing. The purpose of the first section was to associate (if necessary) the level of individuals' understanding on probability theory, with their responses in Stage 1. Also, it allowed us to group the observations of subjects with low understanding of probability theory and check if they are statistically significantly different than others. The second part of the survey allowed us to make comparisons between different genders, age groups, nationalities, professional orientations etc. Finally, the third part of the survey provided us an evidence on whether subjects that have farming background and they are familiar with grain marketing would exhibit a different behavior compared to subjects who don't. Since our sample consisted of undergraduate and graduate students and not producers, it was critical to have an evidence on whether experienced individuals behave differently that inexperienced.

## 5. Analysis and Results

The experimental sessions of this study conducted in the University of Nebraska in Lincoln and in Nebraska College of Technical Agriculture in Curtis. We followed all necessary procedures imposed by the Institutional Review Board and also, we did not use

deception in any stage of our experiment. We ran a total of 15 sessions and each subject could participate only once. 11 sessions took place in Lincoln and 4 sessions in Curtis. As it was mentioned in Section 4, to control for order effects we worked with four different treatment sequences. Table 11 contains the number of subjects participated in each order. Participation in NCTA was lower than the expected and this is the reason that the number of subjects is not balanced in between campuses. However, our sample is balanced across different treatment sequences. More specifically we collected data from 33participants in each price sequence. [32]

Table 11: Number of Experimental Subjects per Treatment Sequence

| | Treatment Sequence 1 | Treatment Sequence 2 | Treatment Sequence 3 | Treatment Sequence 4 | Total |
|---|---|---|---|---|---|
| UNL Participants | 20 | 22 | 21 | 21* | **84** |
| NCTA Participants | 13 | 11 | 11 | 12 | **47** |
| Total | **33** | **33** | **32** | **33** | **131** |

*We dropped out the observations of a participant who refused to participate in the survey.

Our results are presented in four parts. The first part includes the analysis of subjects' Safety First preferences. The second part provides some descriptive statistics on grain marketing decisions. The third part lists the survey results and the fourth part proceeds to econometric results.

### 5.1. Analysis of individuals Safety First Preferences

Following Levy and Levy (2009), we used both the "qualitative" and the "quantitative" method to categorize subjects regarding their Safety First preferences. The qualitative approach is based on subjects' revealed preferences on the first five tasks of

[32] Except Treatment sequence 2 were the total number of participants was 32.

Stage 1 (See Section 3). We examined in how many tasks a participant selected the Safety First prospect and we categorized them as it is shown in table 12. The quantitative approach is based on subjects' stated preferences in the last two tasks, where participants were asked to input a value indicating indifference between both choices.

Table 12: Results of Stage 1 for each Task individually

| Task | Number of participants that selected K | Number of participants that selected L | Percentage of SF in each Task | Percentages of SF found by Levy and Levy (2009) |
|---|---|---|---|---|
| **1** | 110 | 21 | 83.9% | 74.7% |
| **2** | 18 | 113 | 86.3% | 80.2% |
| **3** | 99 | 32 | 75.6% | 78% |
| **4** | 30 | 101 | 77.1% | 66% |
| **5** | 45 | 86 | 65.7% | 70.9% |

More than 50% of individuals selected the SF prospect in each Task. These results are similar to the experimental results of Levy and Levy (2009). A potential explanation for any differences could be the fact that we provided monetary incentives for all five Tasks and not only for one task. Overall, it is remarkable that no matter the unit of the outcome (hundreds, thousands etc.) the majority of participants decided according to SF and not according to other decision theories (Levy and Levy, 2009).

Table 13: Qualitative Categorization of Participants Based on the First 5 Tasks of Stage 1

| **Safety First Category** | **Criterion of Each Category** | **Number of Participants per Category** | **Percentage of the sample** |
|---|---|---|---|
| **"SF"** | Participants who selected the Safety First prospect in all five tasks | 58 | 44.3% |
| **"MIX"** | Participants who selected the Safety First prospect in at least one task but in less than five tasks | 71 | 54.2% |
| **"NO SF"** | Participants who did not select any Safety First prospect in all five tasks | 2 | 1.5% |

We did not divide the "MIX" category into smaller ones because the five Tasks we used in our experiment are not ranked as they are for example in a Holt-Laury (2002) multiple price list. Effectively, we cannot infer that a person who selected two SF prospects exhibits stronger SF preferences compared to a person that selected one. For this reason, we categorized participants a conservative way which does not include any subjective inferences.

Based on the relative weight placed on SF (Task 6 and Task 7 of Stage 1), we categorized as "α SF" the ones that the average α out of both Tasks was $1 \leq \alpha > 0$ and as "α NO SF" the ones that the average α out of both Tasks was equal to 0.

Table 14: Relative Weight of SF based on Tasks 6 and 7 of Stage 1

| | Value estimated based on U(X)=Ax+B | Percentage of the sample | Relative weight α found by Levy and Levy (2009) |
|---|---|---|---|
| **Average α in Task 6** | 0.083 (0.12) | | 0.117 (0.144) |
| **Average α in Task 7** | 0.058 (0.08) | | 0.074 (0.094) |
| **Average α of both Task 6 and Task 7** | 0.070 (0.09) | | 0.096 |
| **Correlation between individual α parameter in Task 6 and Task 7** | 0.48 | | 0.74 |
| **"α SF" Participants with average α of both tasks: 0<α<1** | 83 | 63.35% | |
| **"α NO SF" Participants with average α=0** | 48 | 36,65% | |

For both individual estimates of α in Task 6 and Task 7, the relative weight of SF is slightly lower compared to Levy and Levy (2009). This difference is not surprising because as Levy and Levy (2009) say "typically there is a substantial variation in α across subjects. Note that this is to be expected, as subjects may have different attitudes towards risk, and in particular, the risk of disaster." However, the most interesting difference between our results and Levy's and Levy's results is that the correlation between α in Task 6 and α in Task 7 for each individual. Levy and Levy (2009) found a correlation of 0.74 which is much higher than the correlation of 0.48 we found. Even though 0.48 does not imply a weak relation between the two independent estimates, it demonstrates that our sample varied more between both measures. However, it is important to underline that responses on Task 6 and Task 7 are stated and not revealed preferences in the sense that

we did not provide any monetary incentive for these tasks. Table 15 shows the Spearman correlation between the two measures of SF preferences:

Table 15: Correlation between the 2 measures of SF preferences

| | SF | MIX | NO SF | αSF |
|---|---|---|---|---|
| **SF** | 1 | -0.96 | -0.11 | 0.26 |
| **MIX** | -0.96 | 1 | -0.13 | -0.25 |
| **NO SF** | -0.11 | -0.13 | 1 | -0.03 |
| **αSF** | 0.26 | -0.25 | -0.03 | 1 |

We separately used both the quantitative and the qualitative results to associate SF preferences with grain marketing decisions from Stage 2.

### 5.2. Analysis of Individuals Grain Marketing Decisions

In the grain marketing stage, each subject participated in one practice period that involved 12 rounds. Then, each subject participated in 4 marketing periods (price treatments) with 12 rounds each, hence a total of 48 rounds. In this part, we provide an overview of the results obtained from each price treatment. Before we proceed, it is necessary to list the grain marketing variables that we focused on this study. Our primary interest was to observe how individuals sold their available bushels throughout the year and their profit at the end of a year. That is, whether they sold grain in the spot or in the futures market and how many contracts they created (marketing frequency) throughout the marketing year in different months. Table 16 lists the variables and a brief definition of each variable.

Table 16: Grain Marketing Variables and their definitions

| Variable | Definition |
|---|---|
| **Bushels Sold** | Amount of bushels sold per month regardless of the type of contract used |
| **Bushels Sold at Spot Market** | Amount of bushels sold per month **only through cash contracts (at spot market)** |
| **Marketing Frequency** | Number of contracts created per month |
| **Profit/Loss** | Monetary outcome of each year after subtracting production and storage cost incurred for each month |

Table 17 - Table 20 provide the descriptive statistics of each treatment. These results suggest that except T2 on average participants had positive profits. Also, on average, they marketed their grain multiple times during the year (6.98 contracts per year). This is different than the common approach in literature that perceives marketing as one-time decision (Kastens and Dhuyvetter, 1999).

*Results are pooled across all subjects
** 9792 bu/month on average, calculated by 117,500 bu/12 months
*** The minimum number of contracts that a subject could execute per year was 117,500/25,000≈5, and the maximum was 117,500/5,000≈24 per year

| **Bushels Sold** | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Treatment Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mean** | 36870 | 11813 | 16546 | 11489 | 9866 | 8359 | 7405 | 4294 | 2710 | 2615 | 3073 | 2462 | |
| Standard deviation | 37862 | 13083 | 18575 | 11392 | 15192 | 9858 | 9754 | 8293 | 6013 | 5907 | 9181 | 11072 | |
| max | 117500 | 75000 | 102500 | 50000 | 117500 | 50000 | 50000 | 47500 | 25000 | 37500 | 75000 | 117500 | |
| **Bushels Sold at Spot Market** | | | | | | | | | | | | | |
| mean | 17385 | 2557 | 14905 | 3874 | 2672 | 3664 | 2252 | 3931 | 2405 | 2214 | 973 | 2462 | |
| Standard deviation | 20678 | 6972 | 19033 | 8854 | 6211 | 7901 | 5996 | 8228 | 5780 | 5613 | 3905 | 11072 | |
| max | 117500 | 40000 | 102500 | 50000 | 32500 | 50000 | 30000 | 47500 | 25000 | 37500 | 25000 | 117500 | |
| **Marketing Frequency** | | | | | | | | | | | | | |
| mean*** | 1.92 | 0.75 | 0.91 | 0.72 | 0.64 | 0.60 | 0.53 | 0.34 | 0.25 | 0.24 | 0.26 | 0.20 | **7.35** |
| Standard deviation | 1.84 | 0.71 | 0.86 | 0.64 | 0.76 | 0.58 | 0.57 | 0.52 | 0.44 | 0.45 | 0.55 | 0.49 | 0.47 |
| max | 9 | 3 | 5 | 3 | 5 | 3 | 2 | 2 | 1 | 2 | 3 | 2 | |
| **Profit** | | | | | | | | | | | | | |
| mean | 1725 | -3846 | 1022 | -387 | 260 | 1156 | 2673 | 1358 | 510 | 641 | 1734 | 1723 | **8569** |
| Standard deviation | 10501 | 3364 | 6355 | 3494 | 4675 | 3537 | 4592 | 4179 | 2504 | 2473 | 5681 | 7751 | 9574 |
| max | 30550 | 7125 | 30750 | 10825 | 31075 | 12025 | 25275 | 23750 | 9125 | 15000 | 46025 | 82250 | 30550 |

cs of T1 ("Stable" Price Series)

| Bushels Sold | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Treatment Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mean | 52729 | 16260 | 9962 | 8359 | 6260 | 4771 | 3607 | 2882 | 3340 | 1698 | 3187 | 4447 | |
| Standard deviation | 36847 | 19686 | 14758 | 10953 | 9645 | 8590 | 6963 | 6244 | 7217 | 5346 | 10271 | 12767 | |
| max | 117500 | 97500 | 112500 | 60000 | 50000 | 50000 | 25000 | 25000 | 37500 | 35000 | 75000 | 92500 | |
| **Bushels Sold at Spot Market** | | | | | | | | | | | | | |
| mean | 43550 | 14523 | 9084 | 7195 | 5668 | 4332 | 3263 | 2519 | 1355 | 1641 | 954 | 4447 | |
| Standard deviation | 36151 | 18611 | 14485 | 10656 | 9348 | 8079 | 6643 | 5928 | 5256 | 5342 | 5411 | 12767 | |
| max | 117500 | 97500 | 112500 | 60000 | 50000 | 50000 | 25000 | 25000 | 37500 | 35000 | 50000 | 92500 | |
| **Marketing Frequency** | | | | | | | | | | | | | |
| mean | 2.49 | 0.89 | 0.62 | 0.55 | 0.44 | 0.37 | 0.28 | 0.23 | 0.27 | 0.19 | 0.21 | 0.26 | **6.81** |
| Standard deviation | 1.81 | 0.94 | 0.76 | 0.64 | 0.58 | 0.59 | 0.48 | 0.44 | 0.52 | 0.45 | 0.53 | 0.53 | 0.64 |
| max | 10 | 5 | 5 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | |
| **Profit** | | | | | | | | | | | | | |
| mean | 4789 | -2314 | -2839 | -3303 | -2468 | -2394 | -1554 | -1801 | -944 | -881 | -2156 | -889 | **-16753** |
| Standard deviation | 9848 | 4165 | 2428 | 3306 | 2523 | 3000 | 2083 | 2631 | 1541 | 1712 | 6075 | 2553 | 30445 |
| max | 23500 | 9750 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23500 |

of T2 (Declining Price Series)

| Bushels Sold | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Treatment Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mean | 66412 | 15344 | 10687 | 7977 | 6183 | 4027 | 2252 | 1794 | 1088 | 687 | 134 | 916 | |
| Standard deviation | 39038 | 13692 | 12680 | 10747 | 8200 | 7276 | 5056 | 5453 | 3102 | 2975 | 715 | 3838 | |
| max | 117500 | 50000 | 62500 | 57500 | 35000 | 25000 | 22500 | 40000 | 15000 | 20000 | 5000 | 32500 | |
| **Bushels Sold at Spot Market** | | | | | | | | | | | | | |
| mean | 51927 | 5191 | 9427 | 6240 | 2366 | 3989 | 1050 | 1374 | 630 | 458 | 115 | 916 | |
| Standard deviation | 40929 | 10454 | 12678 | 9371 | 5610 | 7284 | 3946 | 3888 | 2526 | 2477 | 684 | 3838 | |
| max | 117500 | 50000 | 62500 | 42500 | 25000 | 25000 | 22500 | 20000 | 15000 | 20000 | 5000 | 32500 | |
| **Marketing Frequency** | | | | | | | | | | | | | |
| mean | 3.07 | 0.88 | 0.68 | 0.59 | 0.50 | 0.32 | 0.24 | 0.17 | 0.15 | 0.08 | 0.04 | 0.11 | **6.82** |
| Standard deviation | 1.82 | 0.73 | 0.73 | 0.65 | 0.55 | 0.48 | 0.43 | 0.41 | 0.35 | 0.30 | 0.19 | 0.36 | 0.83 |
| max | 8 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | |
| **Profit** | | | | | | | | | | | | | |
| mean | 14773 | 8286 | 5369 | 3429 | 6748 | 5942 | 4093 | 3009 | 1523 | 673 | -50 | 183 | **53977** |
| Standard deviation | 14338 | 9227 | 8467 | 6204 | 9563 | 11169 | 9600 | 9500 | 4636 | 3222 | 262 | 768 | 21898 |
| max | 35250 | 35275 | 43750 | 32750 | 39725 | 39825 | 42750 | 68675 | 22425 | 21825 | 325 | 6500 | 107175 |

tistics of T3 (Erratic Price Series)

| Bushels Sold | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Treatment Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mean | 44008 | 26221 | 16966 | 10210 | 6393 | 5458 | 2557 | 2252 | 1183 | 992 | 439 | 821 | |
| Standard deviation | 36990 | 22960 | 13686 | 12968 | 8298 | 8354 | 6275 | 5691 | 3777 | 3449 | 1565 | 4445 | |
| max | 117500 | 107500 | 60000 | 92500 | 25000 | 40000 | 40000 | 35000 | 27500 | 25000 | 7500 | 42500 | |
| **Bushels Sold at Spot Market** | | | | | | | | | | | | | |
| mean | 19408 | 6947 | 14828 | 4179 | 1927 | 3531 | 1393 | 2214 | 706 | 840 | 305 | 821 | |
| Standard deviation | 27109 | 15287 | 14197 | 10708 | 5663 | 7084 | 5327 | 5689 | 3286 | 3305 | 1352 | 4445 | |
| max | 117500 | 100000 | 60000 | 92500 | 25000 | 30000 | 40000 | 35000 | 27500 | 25000 | 7500 | 42500 | |
| **Marketing Frequency** | | | | | | | | | | | | | |
| mean | 2.19 | 1.36 | 0.92 | 0.70 | 0.48 | 0.44 | 0.22 | 0.22 | 0.15 | 0.11 | 0.08 | 0.08 | **6.97** |
| Standard deviation | 1.79 | 1.12 | 0.70 | 0.70 | 0.53 | 0.54 | 0.43 | 0.47 | 0.37 | 0.32 | 0.28 | 0.33 | |
| max | 9 | 6 | 3 | 4 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | |
| **Profit** | | | | | | | | | | | | | |
| mean | 4461 | 37937 | 36489 | 22351 | 16158 | 15290 | 5122 | 4261 | 2460 | 1491 | 531 | 1313 | **147864** |
| Standard deviation | 10921 | 36613 | 31090 | 29747 | 21724 | 23870 | 13353 | 11087 | 8228 | 5459 | 2081 | 7111 | 66149 |
| Max | 30550 | 171325 | 137475 | 212750 | 67375 | 116475 | 83825 | 67725 | 60500 | 39475 | 10725 | 68000 | 262900 |

tics of T4 (Increasing Price Series)

Before we move to regression results, we present here a first graphical connection between marketing decisions and SF preferences. We include two graphs for each variable of interest. One associates marketing decisions with the qualitative SF distinction (see table 13) and the other associates marketing decisions with the quantitative SF distinction (see table 14). All graphs depict an average of the respective marketing variable pooled across price treatments.

Figure 29: Bushels Sold per month associated with the qualitative specification of SF preferences

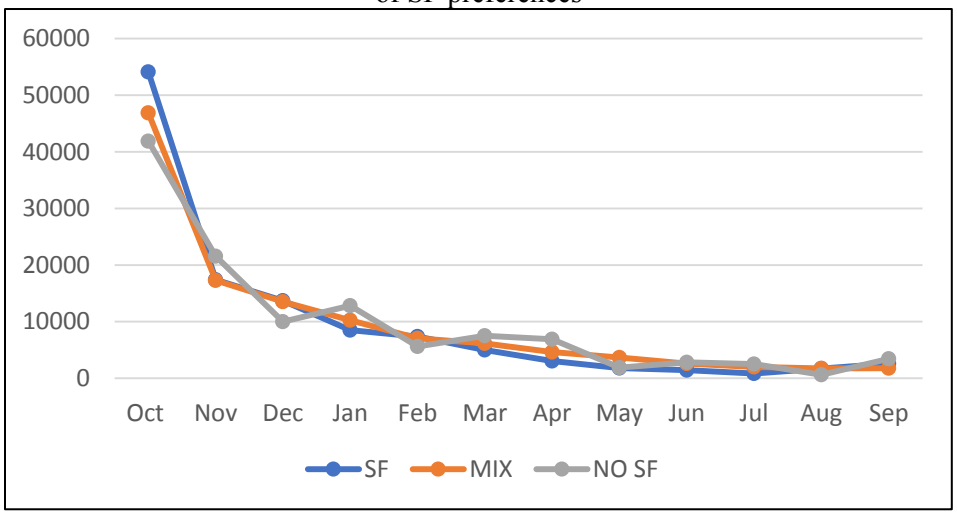
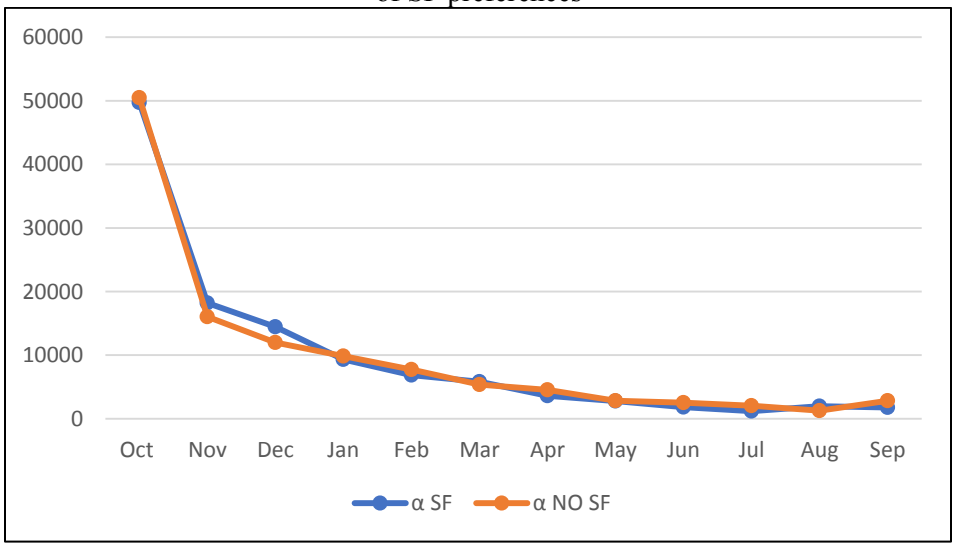



Figure 30: Bushels Sold per month associated with the quantitative specification of SF preferences



In figure 29 is clear that people who showed strong SF preferences in Stage 1 sold more bushels (54,116), right after harvest than Mix (46,875) and NO SF (41,875). When we use the relative weight of SF in figure 30 the difference is small (αSF=49,728, αNo SF=50481).

Figure 31: Bushels sold at spot market per month associated with the qualitative specification of SF preferences

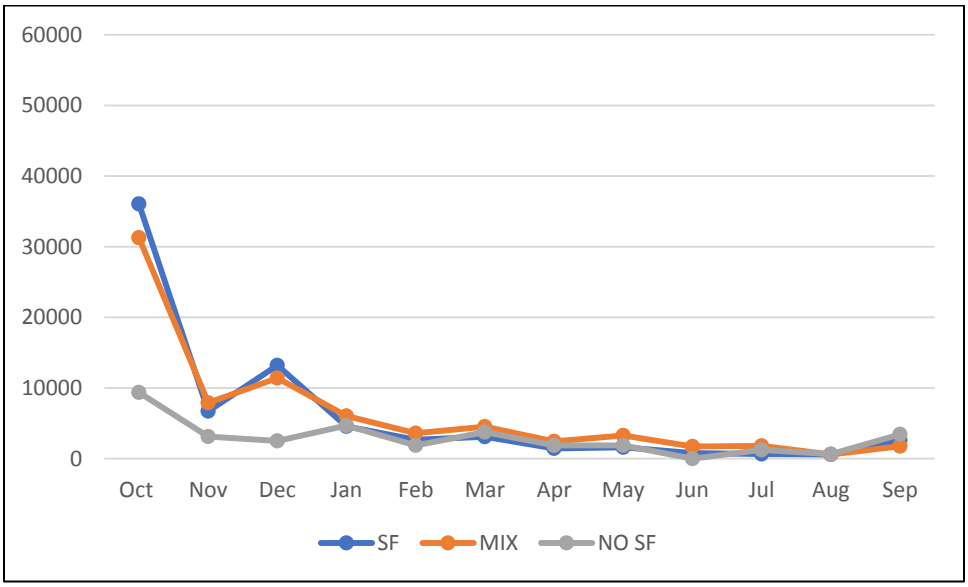
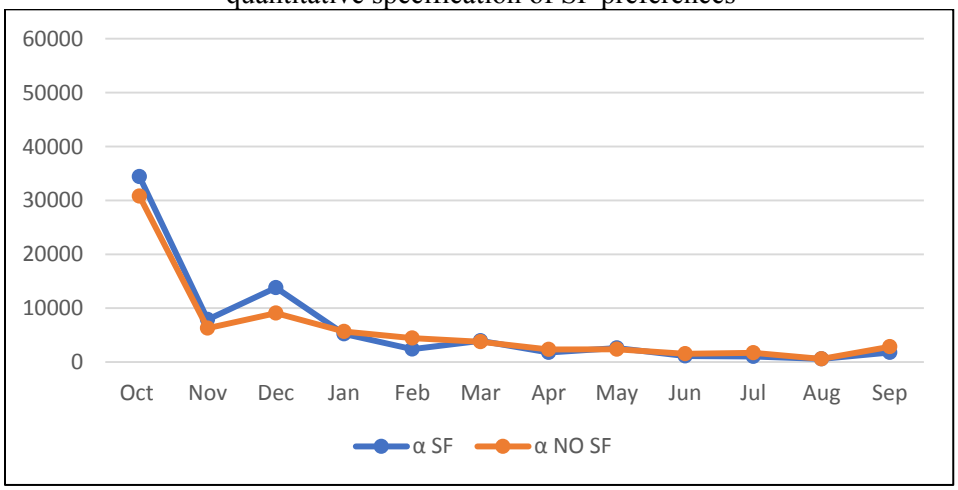



Figure 32: Bushels sold at spot market per month associated with the quantitative specification of SF preferences



Regarding the average bushels sold only at the spot market the results are clear under both SF preferences specifications. Figures 31 shows that individuals with SF preferences sell more bushels (SF=36,066), at harvest price than individuals with MIX (31,285) and NO SF (9,375). Also, individuals that place a relative weight on SF sold more (α SF=34,397) compared to the ones that do not place a value on SF (α NO SF=30,768). We also see that NO SF individuals, from October (harvest) through January sold remarkably less amount of grain in the spot market than the others.

Figure 33: Marketing frequency per month associated with the qualitative specification of SF preferences

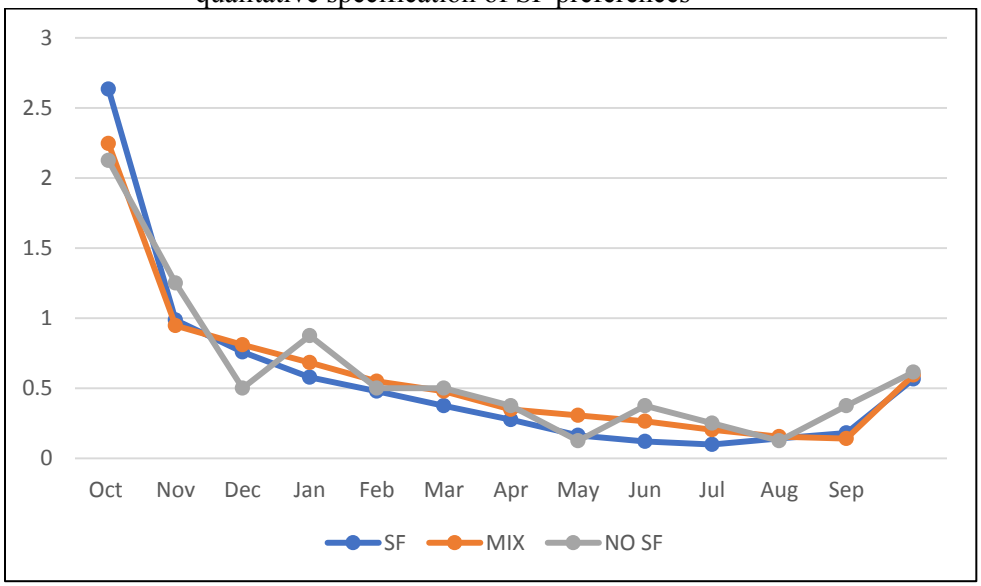
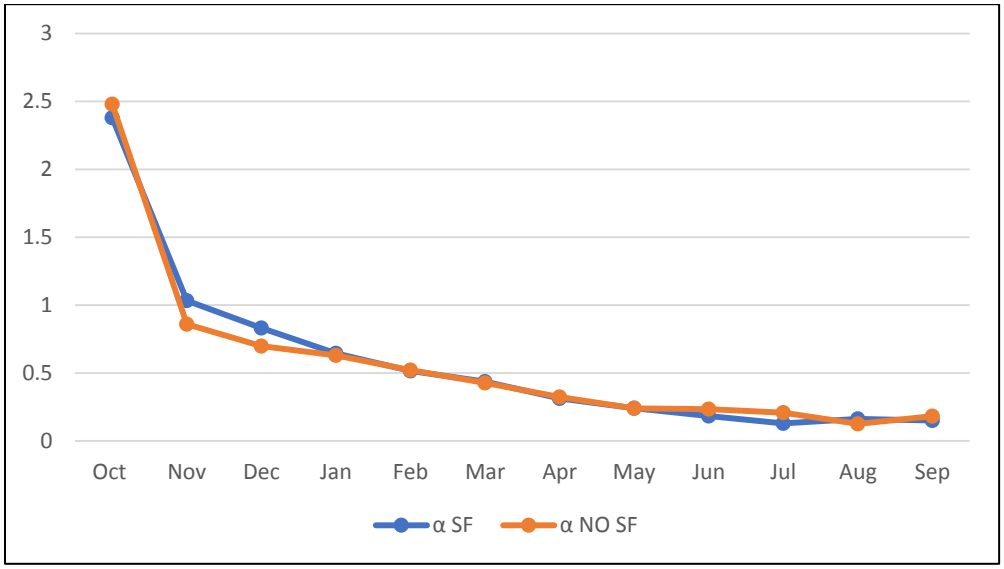


Figure 34: Marketing frequency per month associated with the quantitative specification of SF preferences




Marketing Frequency graphs presented in figures 33 and 34 suggest that people with SF preferences contract slightly more at the beginning of the marketing year compared to others (SF=2.63, MIX=2.24, NO SF=2.12). Especially in figure 33 it is interesting how the behavior of NO SF subjects (and of MIX subject but in smaller extend) changes the last months of the year (May and on). It appears that on average they take the risk of selling the amount that they did not sell at the beginning of the year the last four months.

Figure 35: Average profit associated with the qualitative specification of SF preferences

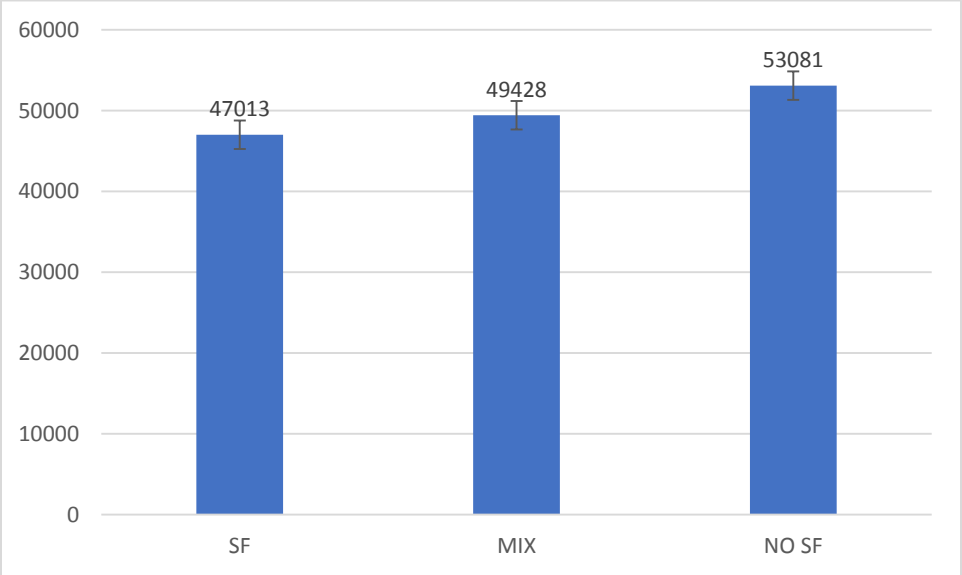
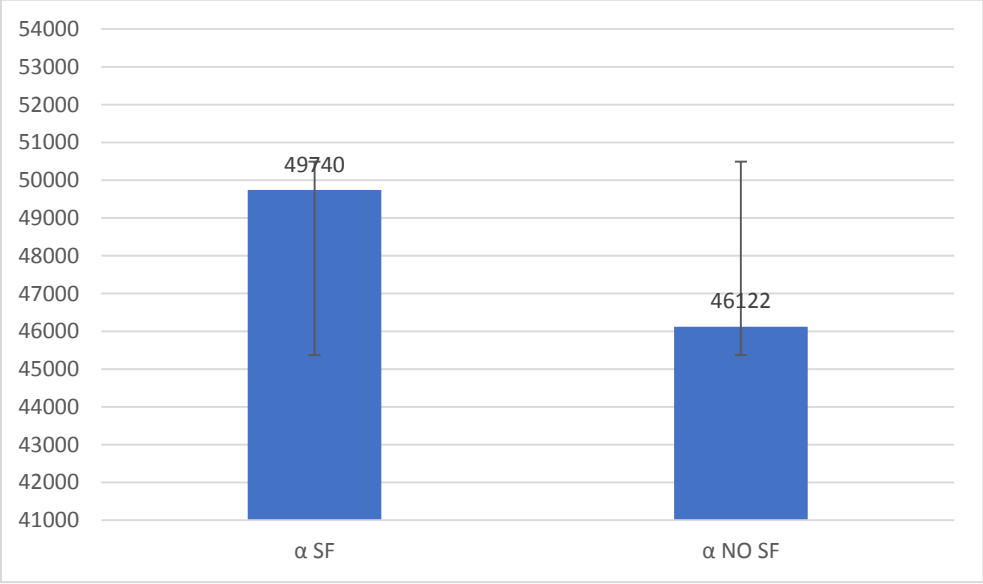



Figure 36: Average profit associated with the quantitative specification of SF preferences




The average profits shown on figures 35 and 36 contradict on each other depending on the preferences measure we used. The qualitative measure suggests that on average SF people made less profit than MIX and NO SF. However, when using the relative weight of SF we obtain the reverse result. A potential reason of this contradiction is the fact the different way that subjects are pooled under each specification. S.E. suggest that the

differences are insignificant. Nevertheless, to make any conclusions about the impact of preferences on profit we need to examine the regression results.

### 5.3. Summary of Survey Results

In this part, we provide the summary results of the Survey. Table 20 lists the results regarding subjects' familiarity with the concept of Expected Value and probability theory. Table 21 contains the results of the typical demographic characteristics and Table 22 presents the results about subjects' familiarity with farming and grain marketing.

Table 21: Results on familiarity with Probability Theory and Expected Value

| Question | Subjects | Percentage of the sample |
|---|---|---|
| Subjects that correctly answered the probability question | 98 | 75% |
| Subjects that felt familiar with the concept of expected value | 59 | 45% |
| Subjects that correctly answered the expected value question | 31 | 24% |

Table 22: Summary Statistics of Socio-Demographic Characteristics

| Characteristic | Subjects | Percentage of the sample |
|---|---|---|
| Males | 73 | 55,7% |
| Age | Average 21 | |
| | Min 18 | |
| | Max 36 | |
| American Nationality | 88 | 67,1% |
| Undergraduate Students | 113 | 86,2% |
| NCTA campus | 47 | 35,8% |
| Subjects that participated for first time in an economic experiment | 95 | 72,5% |
| Subjects that found Instructions Clear | 118 | 90% |

Table 23: Summary Statistics of Farming Background and Familiarity with Grain Marketing

| Question | Subjects | Percentage of the sample |
|---|---|---|
| Subjects that have been farmers | 48 | 36.6% |
| Subjects that someone in their family is farmer | 78 | 59.5% |
| Subjects who were not familiar with grain marketing | 29 | 22.1% |
| Subjects who were slightly familiar with grain marketing | 34 | 25,9% |
| Subjects who were somewhat familiar with grain marketing | 29 | 22.1% |
| Subjects who were moderately familiar with grain marketing | 29 | 22.1% |
| Subjects who were extremely familiar with grain marketing | 10 | 0.07% |

### 5.4. Regression Results

Our primary interest was to econometrically estimate the effect of SF preferences on each variable of interest (amount of bushels sold per month, the amount of bushels sold at spot market per month and marketing frequency per month in a monthly basis) under the four different market conditions. With 12 marketing periods we had 12 regressions, one for each month. The equations we estimated were constructed as:

Regression of $m^{th}$ month for bushels sold at spot market, where m ranges from 1 to 12:

$$\boldsymbol{Spot\ \ bushels_{ikl} = \beta_0 + \beta_1 SF + \beta_2 No\ SF + \beta_k T_k + \beta_l \sum_{l=4} orders + \beta_n \sum_{n=12} controls + \varepsilon_{ikl}}$$

Where:

$Spot\ \ bushels_{ikl}$ are the bushels sold at spot market from the experimental subject i, under kth price treatment and lth price sequence in month m.

$\beta_0$ is the overall intercept

$\beta_1$ is the effect of SF preferences compared to MIX preferences on bushels sold at spot market in month m.

$\beta_2$ is the effect of NO SF preferences compared to MIX preferences on bushels sold at spot market in month m.

$\beta_{\mathrm{k}}$ is the effect of price treatment k on the bushels sold at spot market in month m. k ranges from 1 to 4.

$\beta_{\mathrm{l}}$ is the effect of price sequence l on bushels sold at spot market in month m. l ranges from 1 to 4.

$\beta_n$ is the effect that the control variable n (gender, age, etc.) had on bushels sold at spot market in month m. n ranges from 1 to 12

With two definitions of SF preferences we evaluated each in different regression estimates. One set controlled for SF preferences defined using the qualitative method and the other set controlled for SF preferences using the quantitative method. That is, in the one set of regressions we used a categorical variable with three states (SF, MIX, NOSF), and in the other set we used a binary dummy (αSF, α NO SF). Profit was analyzed as season ending profit for each price treatment. The independent variables remained the same as before. Since we have a total of 74 regressions is practically hard to present all of them. Nevertheless, regressions are available in the following link:

http://rpubs.com/skotsakou2/294122

Here we include only the regressions for each dependent variable where the SF preferences were significant.

### 5.4.1. Regressions for bushels sold per month

**a) Qualitative specification of preferences.**

Table 24: Regressions for bushels sold in October, March, April, May, June, July

| Equation parameter | October | March | April |
|---|---|---|---|
| | **Parameter (Std. Error)** | **Parameter (Std. Error)** | **Parameter (Std. Error)** |
| **Constant** | -44,538*** (15,496.830) | 13,515.260*** (3,626.435) | 10,359.980*** (3,096.403) |
| **Safety First** | 10,568*** (3,449.723) | -1,606.702** (807.275) | -1,876.347*** (689.285) |
| **No Safety First** | 9,080 (13,218.070) | -2,015.854 (3,093.178) | 1,370.024 (2,641.086) |
| **UNL campus** | 2,850.549 (4,551.212) | -1,443.675 (1,065.035) | 607.984 (909.372) |
| **Male** | 1,330.961 (3,655.020) | -540.123 (855.316) | 340.517 (730.305) |
| **Not familiar with grain marketing** | 11,442.930 (7,428.408) | 48.568 (1,738.332) | -811.243 (1,484.261) |
| **Slightly familiar with grain marketing** | 10,246.980 (7,104.250) | 891.376 (1,662.475) | 404.347 (1,419.492) |
| **Somewhat with grain marketing** | 15,325.730** (7,276.938) | -288.367 (1,702.886) | -260.944 (1,453.996) |
| **Moderately familiar with grain marketing** | 11,678.010* (6,865.054) | 535.919 (1,606.501) | -1,257.200 (1,371.698) |
| **Age** | 1,454.963** (570.383) | -57.453 (133.476) | 4.301 (113.967) |
| **Being a farmer** | -2,567.514 (4,432.448) | 1,528.188 (1,037.243) | -31.657 (885.642) |
| **Order 1** | 22,984.100*** (4,602.569) | -3,817.493*** (1,077.054) | -1,267.487 (919.634) |
| **Order 2** | 11,730.160*** (4,506.792) | -2,316.893** (1,054.641) | -845.964 (900.497) |
| **Order 3** | 16,649.220*** (4,553.812) | -3,827.228*** (1,065.644) | -2,869.990*** (909.892) |
| **Nationality** | 7,700.776 (4,760.519) | -199.178 (1,114.016) | -1,502.625 (951.193) |
| **Question on Expected Value** | -1,162.289 (4,217.590) | -698.988 (986.964) | -10.721 (842.712) |
| **Clear Instructions** | 7,348.988 (5,769.520) | 1,629.180 (1,350.133) | 300.862 (1,152.801) |
| **First Experiment** | 15,440.540*** (4,251.641) | -2,119.249** (994.932) | -1,291.709 (849.515) |
| **Year 2002** | 15,858.780*** (4,424.919) | -3,587.786*** (1,035.482) | -3,797.710*** (884.138) |
| **Year 2003** | 29,541.990*** (4,424.919) | -4,332.061*** (1,035.482) | -5,152.672*** (884.138) |
| **Year 2006** | 7,137.405 (4,424.919) | -2,900.763 (1,035.482)*** | -4,847.328*** (884.138) |

Note: * *p<0.1;* ** ***p<0.05;*** *** p<0.01 Observations 524`

Figure 37: Regressions for bushels sold in May, June, June, July

| Equation parameter | May | June | July |
|---|---|---|---|
| | Parameter (Std. Error) | Parameter (Std. Error) | Parameter (Std. Error) |
| Constant | 8,189.822*** (2,766.900) | 6,247.051*** (2,266.837) | 4,156.408* (1,985.623) |
| Safety First | -1,828.948*** (615.935) | -1,597.357*** (504.617) | -1,286.695*** (442.016) |
| No Safety First | -2,872.145 (2,360.035) | -159.484 (1,933.505) | 330.105 (1,693.643) |
| UNL campus | 1,362.118* (812.601) | 824.412 (665.740) | 561.176 (583.151) |
| Male | -470.73 (652.590) | -564.886 (534.647) | -121.400 (468.321) |
| Not familiar with grain marketing | -366.515 (1,326.314) | -1,023.874 (1,086.609) | 151.844 (951.809) |
| Slightly familiar with grain marketing | 1,355.382 (1,268.437) | -244.064 (1,039.192) | 736.555 (910.274) |
| Somewhat with grain marketing | 796.015 (1,299.269) | -477.432 (1,064.452) | 188.214 (932.401) |
| Moderately familiar with grain marketing | 209.846 (1,225.729) | -1,138.081 (1,004.203) | 164.790 (879.626) |
| Age | -9.661 (101.840) | 0.576 (83.434) | -16.979 (73.084) |
| Being a farmer | 791.256 (791.396) | 1,013.112 (648.367) | 112.977 (567.933) |
| Order 1 | -1,672.660** (821.771) | -925.202 (673.252) | -644.334 (589.731) |
| Order 2 | -1,008.437 (804.670) | -1,037.754 (659.242) | -984.501* (577.459) |
| Order 3 | -2,314.769*** (813.066) | -1,035.690 (666.120) | -870.526 (583.484) |
| Nationality | -823.597 (849.972) | -1,499.424** (696.357) | -773.494 (609.970) |
| Question on Expected Value | -429.365 (753.035) | -485.569 (616.938) | -135.547 (540.404) |
| Clear Instructions | -1,818.997* (1,030.126) | -985.431 (843.951) | -422.314 (739.254) |
| First Experiment | -1,318.965* (759.114) | -694.952 (843.951) | 53.528 (544.767) |
| Year 2002 | -1,412.214* (790.052) | 629.771 (647.266) | -916.031 (566.969) |
| Year 2003 | -2,500.000*** (790.052) | -1,622.137** (647.266) | -1,927.481*** (566.969) |
| Year 2006 | -2,041.985** (790.052) | -1,526.718** (647.266) | -1,622.137*** (566.969) |

Note: * *p<0.1;* ** ***p<0.05;*** *** p<0.01 Observations 524`

## b) Quantitative specification of preferences

Table 25: Bushels Sold in February, June, July (with α parameter)

| Equation parameter | February | June | July |
|---|---|---|---|
| | Parameter (Std. Error) | Parameter (Std. Error) | Parameter (Std. Error) |
| **Constant** | 19,163.770*** (4,557.444) | 6,406.987*** (2,274.283) | 4,407.710** (1,987.079) |
| **α Safety First** | -1,937.368* (1,041.629) | -1,048.859** (519.800) | -1,045.707** (454.158) |
| **UNL campus** | -196.761 (1,342.093) | 786.448 (669.739) | 550.346 (585.163) |
| **Male** | 1,175.583 (1,073.783) | -475.800 (535.846) | -60.579 (468.177) |
| **Not familiar with grain marketing** | -2,467.967 (2,192.041) | -942.715 (1,093.885) | 168.073 (955.746) |
| **Slightly familiar with grain marketing** | -180.286 (2,087.375) | -93.863 (1,041.654) | 839.158 (910.111) |
| **Somewhat with grain marketing** | -2,469.281 (2,149.605) | -311.604 (1,072.708) | 249.699 (937.243) |
| **Moderately familiar with grain marketing** | 1,169.065 (2,002.921) | -806.015 (999.510) | 422.085 (873.288) |
| **Age** | -83.340 (167.355) | -7.738 (83.514) | -21.759 (72.968) |
| **Being a farmer** | -966.307 (1,298.178) | 849.711 (647.825) | -3.336 (566.015) |
| **Order 1** | -4,208.308*** (1,354.693) | -1,051.038 (676.027) | -774.203 (590.656) |
| **Order 2** | -1,521.611 (1,331.452) | -1,119.254* (664.429) | -1,069.073* (580.523) |
| **Order 3** | -1,644.719 (1,341.524) | -1,147.121* (669.455) | -984.390* (584.915) |
| **Nationality** | -2,184.187 (1,399.174) | -1,318.761* (698.224) | -677.209 (610.050) |
| **Question on Expected Value** | -1,514.691 (1,241.951) | -509.500 (619.766) | -148.393 (541.500) |
| **Clear Instructions** | -1,623.666 (1,689.127) | -1,163.083 (842.918) | -531.151 (736.472) |
| **First Experiment** | -1,715.580 (1,249.069) | -668.217 (623.318) | 68.051 (544.603) |
| **Year 2002** | -3,606.870*** (1,303.422) | 629.771 (650.441) | -916.031 (568.302) |
| **Year 2003** | -3,683.206*** (1,303.422) | -1,622.137** (650.441) | -1,927.481*** (568.302) |
| **Year 2006** | -3,473.282*** (1,303.422) | -1,526.718** (650.441) | -1,622.137*** (568.302) |

Note: * *p<0.1;* ** ***p<0.05;*** *** p<0.01

The regression results for the amount of bushels sold by individuals per month suggest that the existence of SF preferences had an impact on their decisions. More specifically, the regressions estimated with the quantitative measure of preferences show that individuals with strong SF preferences sell significantly more grain right after harvest (October). Furthermore, subjects with strong SF preferences leave significantly less amount to be sold the second half of the year (March-April and on). Regressions estimated based on the relative weight α of SF preferences do not verify that there was a significant impact of SF preferences for the bushels sold on October. Nevertheless, the estimates for June, and July lead to the same conclusion as the estimates for June and July with the quantitative measure. Additionally, the different price treatments also affected participants' decisions on the amount of grain that they sold monthly. Also, even though we controlled for order effects, the order that the treatments were presented to subjects played a significant role on how they allocated their grain during the marketing year.

### 5.4.2. Regressions for bushels sold at spot market per month

#### a) Qualitative specification of preferences

Table 26: Bushels Sold at Spot Market in October, March, April

| Equation parameter | October | March | April |
|---|---|---|---|
| | Parameter (Std. Error) | Parameter (Std. Error) | Parameter (Std. Error) |
| **Constant** | -24,707.000* (14,041.590) | -7,965.015** (3,219.418) | 3,688.175 (2,386.513) |
| **Safety First** | 7,243.581** (3,125.775) | 1,478.018** (716.669) | -999.702* (531.257) |
| **No Safety First** | -14,007.500 (11,976.820) | -3,722.749 (2,746.012) | -1,522.859 (2,035.582) |
| **UNL campus** | 987.778 (4,123.828) | -753.349 (945.500) | 993.444 (700.887) |
| **Male** | 3,444.260 (3,311.793) | -1,247.043 (759.319) | -1,192.795** (562.873) |
| **Not familiar with grain marketing** | 4,553.825 (6,730.839) | 1,566.368 (1,543.228) | -1,103.898 (1,143.975) |
| **Slightly familiar with grain marketing** | 4,157.150 (6,437.122) | 2,969.415** (1,475.886) | 742.939 (1,094.055) |
| **Somewhat with grain marketing** | 9,866.604 (6,593.594) | 1,237.269 (1,511.761) | -47.252 (1,120.649) |
| **Moderately familiar with grain marketing** | 7,244.573 (6,220.388) | 2,647.639* (1,426.193) | -132.195 (1,057.218) |
| **Age** | 799.972 (516.821) | -93.031 (118.495) | 18.624 (87.839) |
| **Being a farmer** | -5,594.248 (4,016.216) | 1,052.181 (920.827) | 141.418 (682.597) |
| **Order 1** | 14,680.250*** (4,170.362) | -2,181.941** (956.169) | -256.582 (708.796) |
| **Order 2** | 11,636.000*** (4,083.580) | -802.115 (936.272) | 40.418 (694.046) |
| **Order 3** | 15,810.260*** (4,126.184) | -2,089.825** (946.040) | -1,083.010 (701.287) |
| **Nationality** | 3,034.863 (4,313.480) | 93.591 (988.983) | 96.893 (733.120) |
| **Question on Expected Value** | -3,798.268 (3,821.535) | 122.174 (876.191) | -429.753 (649.509) |
| **Clear Instructions** | 3,426.568 (5,227.730) | 427.400 (1,198.600) | -131.984 (888.506) |
| **First Experiment** | 2,652.059 (3,852.388) | -2,693.855*** (883.265) | -995.898 (654.753) |
| **Year 2002** | 26,164.120*** (4,009.395) | 667.939 (919.263) | 1,011.450 (681.438) |
| **Year 2003** | 34,541.990*** (4,009.395) | 324.427 (919.263) | -1,202.290* (681.438) |
| **Year 2006** | 2,022.901 (4,009.395) | -133.588 (919.263) | 858.779 (681.438) |

Note: * *p<0.1;* ** ***p<0.05;*** *** p<0.01 Observations 524

Figure 38: Bushels Sold at Spot Market in May, June, July

| Equation parameter | May | June | July |
|---|---|---|---|
| | Parameter (Std. Error) | Parameter (Std. Error) | Parameter (Std. Error) |
| **Constant** | 7,733.403*** (2,598.252) | 5,298.885*** (1,880.054) | 3,905.638** (1,901.782) |
| **Safety First** | -1,782.277*** (578.392) | -1,241.559*** (418.516) | -1,262.690*** (423.352) |
| **No Safety First** | -2,741.492 (2,216.186) | -2,147.876 (1,603.597) | -916.112 (1,622.130) |
| **UNL campus** | 1,254.366 (763.072) | 1,538.941*** (552.147) | 696.729 (558.528) |
| **Male** | -587.948 (612.813) | -846.829* (443.422) | -91.526 (448.546) |
| **Not familiar with grain marketing** | -927.121 (1,245.472) | -375.989 (901.204) | -283.583 (911.619) |
| **Slightly familiar with grain marketing** | 930.685 (1,191.123) | 852.644 (861.878) | 537.523 (871.838) |
| **Somewhat with grain marketing** | -20.228 (1,220.076) | 149.541 (882.828) | -53.929 (893.031) |
| **Moderately familiar with grain marketing** | 129.851 (1,151.018) | -16.143 (832.859) | 138.362 (842.484) |
| **Age** | -0.651 (95.632) | -57.048 (69.198) | -32.305 (69.998) |
| **Being a farmer** | 486.414 (743.159) | 1,063.021** (537.738) | 249.679 (543.953) |
| **Order 1** | -1,706.263** (771.682) | -674.846 (558.377) | -311.512 (564.830) |
| **Order 2** | -822.199 (755.624) | -637.441 (546.758) | -661.141 (553.077) |
| **Order 3** | -2,435.002*** (763.508) | -328.494 (552.462) | -796.458 (558.847) |
| **Nationality** | -931.732 (798.165) | -1,107.706* (577.539) | -518.909 (584.214) |
| **Question on Expected Value** | 4.244 (707.136) | -18.496 (511.672) | 2.468 (517.586) |
| **Clear Instructions** | -1,187.082 (967.337) | -1,106.757 (699.950) | -263.157 (708.039) |
| **First Experiment** | 1,450.845** (712.845) | -505.729 (515.803) | -224.720 (521.764) |
| **Year 2002** | -1,412.214* (741.897) | -1,049.618* (536.825) | -572.519 (543.029) |
| **Year 2003** | -2,557.252*** (741.897) | -1,774.809*** (536.825) | -1,755.725*** (543.029) |
| **Year 2006** | -1,717.557** (741.897) | -1,698.473*** (536.825) | -1,374.046** (543.029) |

Note: * *p<0.1;* ** ***p<0.05;*** *** p<0.01 Observations 524

### b) Quantitative specification of preferences

Table 27: Bushels Sold at Spot Market in October, December, February, (with α parameter)

| Equation parameter | October | December | February |
|---|---|---|---|
| | Parameter (Std. Error) | Parameter (Std. Error) | Parameter (Std. Error) |
| **Constant** | -27,772.060** (14,044.540) | 26,061.050*** (6,498.660) | 6,859.977** (2,913.934) |
| **α Safety First** | 6,780.251** (3,209.959) | 3,935.412*** (1,485.305) | -2,281.307*** (665.996) |
| **UNL campus** | 1,105.657 (4,135.889) | -434.012 (1,913.750) | 843.488 (858.106) |
| **Male** | 3,216.516 (3,309.046) | -3,713.620** (1,531.154) | -756.628 (686.554) |
| **Not familiar with grain marketing** | 4,705.664 (6,755.149) | -5,811.980* (3,125.728) | 426.717 (1,401.545) |
| **Slightly familiar with grain marketing** | 3,382.786 (6,432.603) | -6,381.869** (2,976.480) | 2,317.056* (1,334.624) |
| **Somewhat with grain marketing** | 9,777.305 (6,624.373) | -7,581.630** (3,065.216) | 757.494 (1,374.412) |
| **Moderately familiar with grain marketing** | 5,542.537 (6,172.344) | -5,025.399* (2,856.054) | 1,475.316 (1,280.626) |
| **Age** | 868.994* (515.733) | -171.578 (238.639) | -87.480 (107.003) |
| **Being a farmer** | -5,141.004 (4,000.558) | -854.674 (1,851.130) | 765.587 (830.028) |
| **Order 1** | 15,799.270*** (4,174.717) | -1,490.940 (1,931.716) | -1,742.336** (866.162) |
| **Order 2** | 12,174.510*** (4,103.095) | 75.404 (1,898.575) | 33.403 (851.302) |
| **Order 3** | 16,754.360*** (4,134.137) | -3,049.390 (1,912.939) | -920.680 (857.743) |
| **Nationality** | 2,322.683 (4,311.793) | -168.988 (1,995.143) | -501.454 (894.602) |
| **Question on Expected Value** | -3,633.665 (3,827.284) | 1,227.311 (1,770.953) | -1,027.615 (794.078) |
| **Clear Instructions** | 3,616.092 (5,205.332) | 1,160.535 (2,408.600) | -493.224 (1,079.992) |
| **First Experiment** | 2,843.337 (3,849.220) | -2,515.520 (1,781.103) | -1,307.363 (798.629) |
| **Year 2002** | 26,164.120*** (4,016.717) | -5,820.611*** (1,858.607) | 2,996.183*** (833.381) |
| **Year 2003** | 34,541.990*** (4,016.717) | -5,477.099*** (1,858.607) | -305.344 (833.381) |
| **Year 2006** | 2,022.901 (4,016.717) | -76.336 (1,858.607) | -744.275 (833.381) |

Note: * *p<0.1;* ** ***p<0.05;*** *** p<0.01 Observations 524

The regression results with the quantitative distinction of SF preferences for the bushels sold at spot market per month suggest something interesting. Subjects who exhibit strong SF preferences sell significantly more amount of grain in the cash price offered at harvest. That is, they are willing to give up the opportunity of a better price even in the near future, as well as they do not place value on carry opportunities that the market offers through futures contracts. Additionally, for the last six months of the year subjects with strong SF preferences sell significantly less amount of grain at the spot market. The regression results of the quantitative analysis verify the fact that subjects who place value on SF prefer to sell more grain on harvest price, and hence remove the price risk for a greater proportion of their grain.

It is worth noting that the regressions where participants have been distinguished based on the α parameter have a positive coefficient on SF preferences until December compared to the regressions with the qualitative measure of SF preferences where the coefficient of SF switches from positive to negative in November. This is not surprising if we recall the way that subjects have been pooled in the quantitative specification of SF preferences. Any value of parameter α greater than zero classifies the subject as SF and any value of parameter α equal to zero classifies the subject as NO SF. Therefore, SF category includes both subjects that place low and high value on SF. Hence, the subjects that place low value on SF they sell early in the year (first half of the year) but apparently later than the ones that place high value on SF (first month of the year). Pooling these subjects in the same group results in getting a positive instead of negative coefficient on SF preferences until December.

#### 5.4.3. Regressions for marketing frequency per month

**Qualitative specification of preferences**

Table 28: Marketing Frequency in October, December, January, February

| Equation parameter | October | December | January | February |
|---|---|---|---|---|
| | Parameter (Std. Error) | Parameter (Std. Error) | Parameter (Std. Error) | Parameter (Std. Error) |
| **Constant** | -1.665** (0.751) | 1.778*** (0.326) | 1.509*** (0.275) | 1.086*** (0.258) |
| **Safety First** | 0.540*** (0.167) | -0.127* (0.073) | -0.120* (0.061) | -0.117** (0.058) |
| **No Safety First** | 0.448 (0.641) | -0.453 (0.278) | 0.067 (0.235) | -0.190 (0.220) |
| **UNL campus** | 0.331 (0.221) | 0.067 (0.096) | 0.094 (0.081) | 0.087 (0.076) |
| **Male** | -0.153 (0.177) | -0.122 (0.077) | 0.068 (0.065) | 0.107* (0.061) |
| **Not familiar with grain marketing** | 0.480 (0.360) | -0.104 (0.156) | 0.208 (0.132) | -0.012 (0.124) |
| **Slightly familiar with grain marketing** | 0.571* (0.344) | -0.155 (0.150) | 0.150 (0.126) | 0.057 (0.118) |
| **Somewhat with grain marketing** | 0.789** (0.353) | -0.384** (0.153) | 0.024 (0.129) | -0.106 (0.121) |
| **Moderately familiar with grain marketing** | 0.397 (0.333) | -0.172 (0.144) | 0.094 (0.122) | 0.103 (0.114) |
| **Age** | 0.056** (0.028) | -0.023* (0.012) | -0.030*** (0.010) | -0.010 (0.010) |
| **Being a farmer** | -0.075 (0.215) | 0.051 (0.093) | 0.018 (0.079) | -0.086 (0.074) |
| **Order 1** | 0.927*** (0.223) | -0.094 (0.097) | -0.311*** (0.082) | -0.245*** (0.077) |
| **Order 2** | 0.293 (0.218) | -0.059 (0.095) | -0.282*** (0.080) | -0.085 (0.075) |
| **Order 3** | 0.444** (0.221) | -0.088 (0.096) | -0.260*** (0.081) | -0.142* (0.076) |
| **Nationality** | 0.396* (0.231) | -0.078 (0.100) | -0.095 (0.085) | -0.226*** |
| **Question on Expected Value** | -0.183 (0.204) | 0.008 (0.089) | -0.034 (0.075) | -0.056 (0.070) |
| **Clear Instructions** | 0.501* (0.280) | -0.002 (0.121) | -0.084 (0.103) | -0.031 (0.096) |
| **First Experiment** | 0.795*** (0.206) | -0.064 (0.089) | 0.001 (0.076) | -0.059 (0.071) |
| **Year 2002** | 0.573*** (0.214) | -0.290*** (0.093) | -0.168** (0.079) | -0.198*** (0.074) |
| **Year 2003** | 1.153*** (0.214) | -0.229** (0.093) | -0.130* (0.079) | -0.137* (0.074) |
| **Year 2006** | 0.275 (0.214) | 0.015 (0.093) | -0.015 (0.079) | -0.160** (0.074) |

Note: * *p<0.1;* ** ***p<0.05;*** *** p<0.01 Observations 524

Table 29: Marketing Frequency in March, April, May, June, July

| Equation parameter | March | April | May | June | July |
|---|---|---|---|---|---|
| | Parameter (Std. Error) | Parameter (Std. Error) | Parameter (Std. Error) | Parameter (Std. Error) | Parameter (Std. Error) |
| **Constant** | 1.193*** (0.229) | 0.857*** (0.206) | 0.758*** (0.194) | 0.559*** (0.180) | 0.311* (0.165) |
| **Safety First** | -0.162*** (0.051) | -0.095** (0.046) | -0.145*** (0.043) | -0.170*** (0.040) | -0.125*** (0.037) |
| **No Safety First** | -0.196 (0.195) | -0.083 (0.175) | -0.308* (0.166) | 0.066 (0.154) | 0.009 (0.141) |
| **UNL campus** | 0.0003 (0.067) | 0.091 (0.060) | 0.083 (0.057) | 0.112** (0.053) | 0.090* (0.049) |
| **Male** | -0.060 (0.054) | 0.004 (0.048) | -0.017 (0.046) | -0.009 (0.043) | -0.031 (0.039) |
| **Not familiar with grain marketing** | -0.055 (0.110) | -0.019 (0.099) | 0.083 (0.093) | 0.054 (0.086) | 0.083 (0.079) |
| **Slightly familiar with grain marketing** | -0.019 (0.105) | 0.088 (0.094) | 0.216** (0.089) | 0.089 (0.083) | 0.107 (0.076) |
| **Somewhat with grain marketing** | -0.143 (0.108) | 0.011 (0.097) | 0.103 (0.091)) | 0.001 (0.085) | 0.019 (0.078) |
| **Moderately familiar with grain marketing** | -0.028 (0.101) | -0.015 (0.091) | 0.085 (0.086) | -0.027 (0.080) | 0.018 (0.073) |
| **Age** | -0.010 (0.008) | -0.008 (0.008) | -0.011 (0.007) | -0.007 (0.007) | -0.001 (0.006) |
| **Being a farmer** | 0.113* (0.066) | -0.002 (0.059) | 0.055 (0.056) | 0.081 (0.052) | 0.044 (0.047) |
| **Order 1** | -0.215*** (0.068) | -0.104* (0.061) | -0.136** (0.058) | -0.079 (0.054) | -0.083* (0.049) |
| **Order 2** | -0.189*** (0.067) | -0.081 (0.060) | -0.113** (0.056) | -0.097* (0.052) | -0.099** (0.048) |
| **Order 3** | -0.257*** (0.067) | -0.235*** (0.060) | -0.189*** (0.057) | -0.110** (0.053) | order3 -0.094* |
| **Nationality** | -0.095 (0.070) | -0.123* (0.063) | -0.066 (0.060) | -0.102* (0.055) | -0.063 (0.051) |
| **Question on Expected Value** | -0.090 (0.062) | -0.028 (0.056) | -0.010 (0.053) | -0.043 (0.049) | -0.044 (0.045) |
| **Clear Instructions** | 0.059 (0.085) | 0.034 (0.077) | -0.066 (0.072) | -0.074 (0.067) | 0.010 (0.062) |
| **First Experiment** | -0.147** (0.063) | -0.097* (0.056) | -0.128** (0.053) | -0.045 (0.049) | -0.001 (0.045) |
| **Year 2002** | -0.221*** (0.065) | -0.244*** (0.059) | -0.115** (0.055) | 0.015 (0.051) | -0.053 (0.047) |
| **Year 2003** | -0.275*** (0.065) | -0.290*** (0.059) | -0.176*** (0.055) | -0.107** (0.051) | -0.160*** (0.047) |
| **Year 2006** | -0.153** (0.065) | -0.305*** (0.059) | -0.122** (0.055) | -0.107** (0.051) | -0.130*** (0.047) |

Note: * *p<0.1;* ** ***p<0.05;*** *** p<0.01 Observations 524

The regressions of Marketing Frequency where preferences were categorized based on the relative weight of SF did not yield any significant estimates on SF preferences, although they had the appropriate sign. Also, SF preferences were not significant for profits in any regression. The regressions on marketing frequency with the qualitative specification of preferences (SF, MIX, NO SF) are consistent with the remaining analysis. Participants with strong SF preferences show significantly higher marketing frequency right after harvest compared to participants with low SF preferences.

The absence of significance for profit reveals an interesting conclusion. Recall that the dependent variable for profit regressions was the profit per game (not per month) for each individual for all price treatments. Therefore, keeping everything else constant, preferences did not appear to be a significant determinant of the profit in the long-run. The different price fluctuations from price treatment to price treatment offset any differences in profit. Since our price treatments are actual market prices happened in different marketing years in the past, our result is an evidence that even though grain marketing decisions are affected by individuals' SF preferences, in the long run the monetary outcome may remain unaffected.

## 6. Summary and Conclusions

In this study, we investigated whether Safety First (SF) preferences influence grain marketing decisions. We ran a context rich economic experiment that involved 3 stages. In stage 1 we elicited SF preferences with a method proposed by Levy and Levy (2009). In Stage 2 we recorded participants' grain marketing decisions on a grain marketing simulation game. Finally, in Stage 3 we surveyed participants about their sociodemographic characteristics.

Our results were found to be similar to those found by Levy and Levy (2009), that SF matters in decision making. Going to the grain marketing, we found that SF preferences influence the amount of bushels sold through forward contracts, the amount of bushels sold at spot market as well as the marketing frequency. Specifically, individuals who showed strong SF preferences sold significantly more grain at the beginning of the marketing year compared to individuals with low SF preferences. However, the presence of SF preferences was not a significant determinant of the profit. This finding leads us to the conclusion that different market fluctuations from year to year offset any difference in profit regardless individuals' risk preferences. That is, a certain segment of producers, those with SF preferences, will sell at harvest regardless of price expectations. Sometimes they win and sometimes they lose but there is no difference in their profit over time when it is compared with people with different SF preferences. Results from this study provide evidence that it may not be optimal to consider that all producers follow the same marketing strategies. Finally, the use of the grain marketing simulation game and in general the experimental approach of grain marketing decisions allowed us to observe decisions that are unobservable in real world. Our findings suggest that simulation games and context rich experiments can be a powerful tool solving important limitations such as lack of necessary data and reducing the divergence between theoretical and empirical findings.

## Future Work

Our results indicated that MINE game serves as an efficient data source for grain marketing decisions. Therefore, it would be interesting to repeat the same experiment in the field. This way we will have an opportunity to work with producers and hence, to increase the complexity of the environment by adding more types of contracts.

Also, it is essential to repeat the study for pre-harvest marketing and observe the differences in behavior when yield risk is present. More specifically, an experiment that allows for both pre- and post-harvest decisions with producers as subjects would be an ideal set up to examine in depth marketing decisions. In addition, in this study costs and yield were the same for all subjects. It would be interesting to examine the differences in economies of scale by varying the numbers of the yield and the cost. Finally, in this study grain marketing decisions are perceived as individual decisions. However, producers are influenced from their family as well as from their peers (other farmers etc.). Therefore, it appears it would be useful to evaluate the role of social interactions on producers' marketing decisions.

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## Appendix I: Instructions

Thank you for participating in today's experiment!

1

**Are you registered???**

Please go to: ebe-lab.unl.edu

You will get notifications for the upcoming experiments!

**General Information**

Please:

✓Switch off your cell phones. 

✓Do not talk with one another, exclaim, turn around or look at other participants' screens.

✓**Do not click "continue" at any point without the experimenter asking you to do so.**

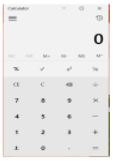
3

## General Information

Please:

✓Do not write on the instructions. You have scratch paper.

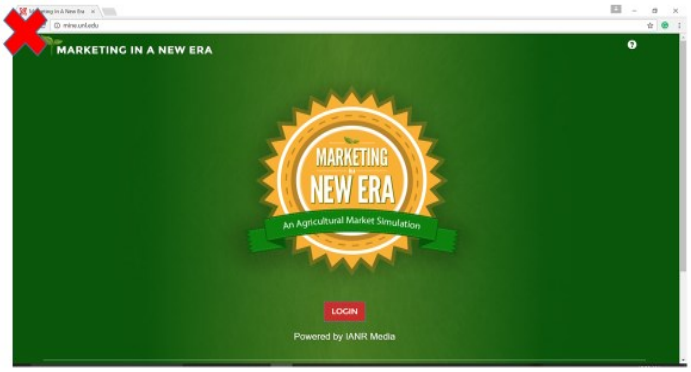
✓There is calculator available in your computer.



✓If you have questions raise your hand and wait for the experimenter to come to you and answer your questions in private.

4

## Important




**Please DO NOT click on backspace. This action will drive you out of the environment of the experiment and your decisions will be lost. Therefore, you may not be paid.**

5

## General Information

**Participants intentionally violating the rules may be asked to leave the experiment and may not be paid.**

6

## General Information

✓ **3 stages**

✓ **performance during the experiment + $7 participation fee**

✓Your earnings will be added up and you will be paid privately.

✓The exact amount you will receive will be determined during the experiment.

7

## General Information

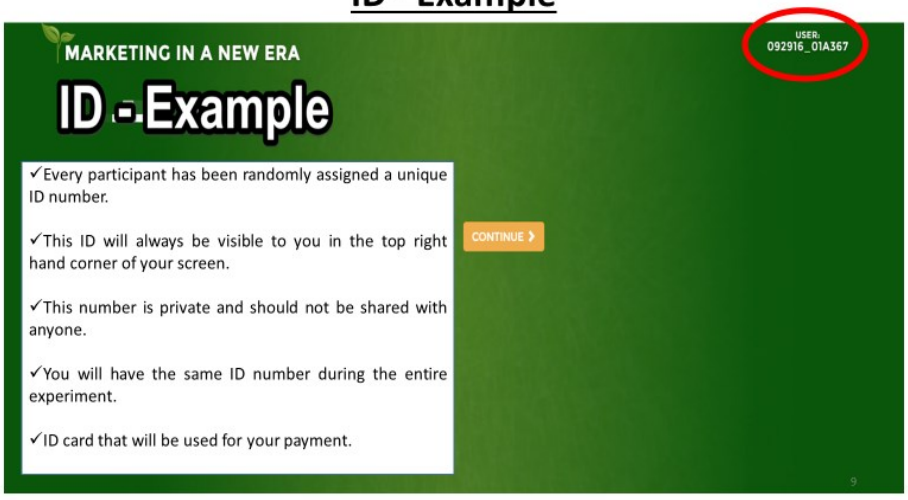
✓ **Experimental currency units (ECUs)**

✓ **Rate of 1 U.S. dollar for every 12,611 ECUs.**

✓You will need to have a good understanding of the features of today's experiment since your decisions will affect how much you will be paid.

8

## ID - Example




9

# Stage 1

10

## Stage 1

✓**7 decision scenarios where you have to chose between two options.**

✓ In the first **5,** you have to choose between alternatives **K** and **L**.
- ❑In both alternatives your payment depends on chance.

✓ In the last **2**, you have to **type a number** in a box which will make you indifferent between alternatives **K** and **L**.

✓We will see one example for both categories.

✓Quiz to check your understanding

11

## Stage 1 – Example of Type 1 question

TIME REMAINING: 00 PLEASE MAKE YOUR DECISION

| K | | | L | |
|---|---|---|---|---|
| Outcome in ECU | Probability | Please indicate your choice | Outcome in ECU | Probability |
| | | | | |
| -600 | 0.33 | K O O L | -300 | 0.33 |
| 200 | 0.33 | | -100 | 0.33 |
| 1,100 | 0.33 | | 1,100 | 0.33 |

Alternative K (left)


Alternative L (right)

## Stage 1 – Example of Type 2 question

**Below are two options, K and L. What value X will make you indifferent between two options?**

TIME REMAINING: 00 PLEASE MAKE YOUR DECISION

| K | | L | |
|---|---|---|---|
| **Outcome in ECUs** | Probability | **Outcome in ECUs** | Probability |
| **-20,000** | **0.33** | **- 4,000** | **0.33** |
| **1,500** | **0.33** | **-500** | **0.33** |
| **40,000** | **0.33** | **x** | **0.33** |

Alternative L (right)


Please raise your hand if you have any questions. Otherwise, click continue.

13

## Payment in Stage 1

✓Your earnings from Stage 1 will be determined at the end of the experiment and will be added to your earnings from Stage 2.

✓**Only one** of the 5 first decisions you make will be used for computing your earnings in **Stage 1**.

✓The decision task will be selected **at random**

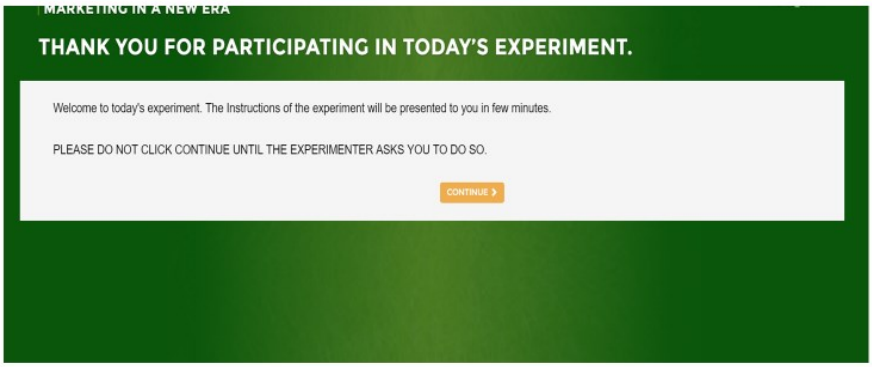
✓**Each decision task has the same probability of being picked.**

✓The decision task that will be picked will be the same for everyone in the room.

✓Once the decision scenario has been picked, cards will be picked to determine the payoff for people who chose alternative K or L for this decision task.

14

## Stage 1

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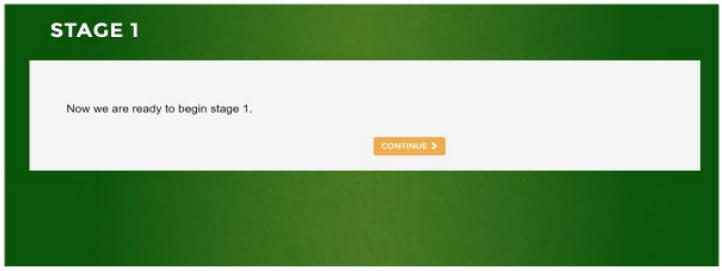
## Stage 1




**Click continue to proceed to the quiz.**

**After completing the quiz, the computer will automatically proceed to Stage 1.**

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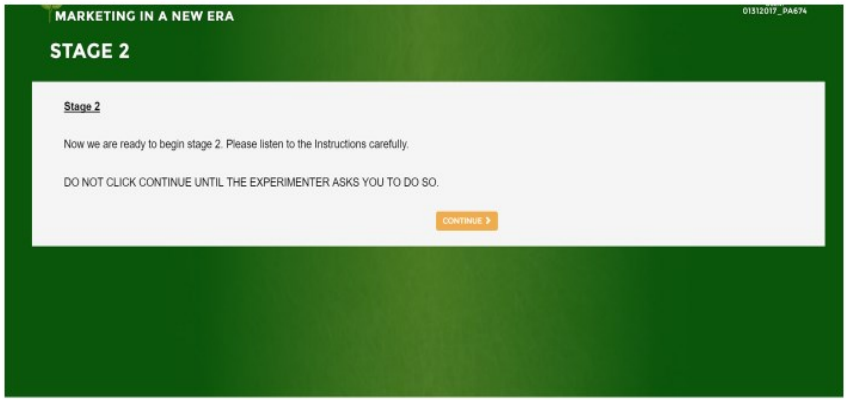
## Stage 1




**Once this message appears in your screen, please DO NOT click continue until the experimenter provides you with Instructions for Stage 2.**

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# Stage 2

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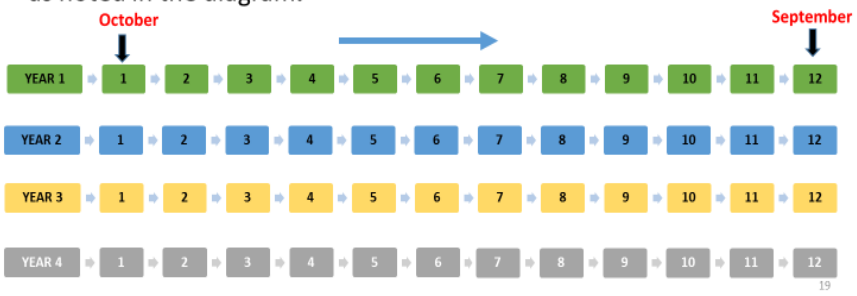
## Stage 2: Years & Months

- In this stage you will assume the role of a **farmer** who **produces and sells** a single **grain** (e.g. corn) **in the market**.
- You will sell the grain within **12 months for 4 different production years** as noted in the diagram.

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## Stage 2: General Information

- Every year in October, you produce **117,500** bushels of grain (e.g. corn)


- You sell this grain over the next **12 months** of the year to generate your earnings.

1 → 2 → 3 → 4 → 5 → 6 → 7 → 8 → 9 → 10 → 11 → 12

- The earnings that you have made in September correspond to your experimental payoff in ECU in that Year.
- The higher the earnings the higher your payment at the end of the experiment.

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## Stage 2: General Information

- In order to increase your earnings from selling your grain, you should consider:
  - ✓the cost of producing the 117,500

  - ✓the cost of storing the grain

  - ✓the grain prices on the market in the current and future months

- All these values will be available to you when you make your decisions to sell grain.

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## Stage 2: Description of your costs

-  **The Production cost:** is the cost of producing the 117,500 bushels of grain.

- The value of the production cost is **3.8 ECUs/bushel**.

- Your production cost **will be deducted from your earnings at the end of the year**.

- Your **Production Cost for the experiment** is: 117,500 x 3.8 = **446,500 ECUs**

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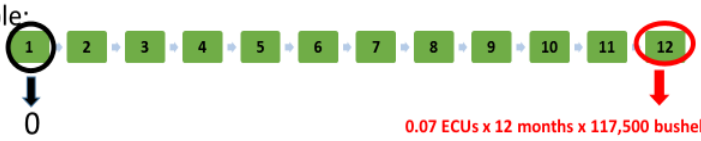
## Stage 2: Description of your costs

-  **Storage cost:** You pay an extra **0.07/bu/month** ECUs if you decide to not sell your grain and store it until the next month.

- **The Total Storage cost depends upon how much grain you stored each month.**
- Example:




- **The storage cost will be deducted from your Earnings at the end of each month.**

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## Stage 2: Description of your costs

**Total Cost =**  + 

Production Cost Storage Cost

- The computer calculates this cost and displays it at the end of the year in your **summary screen.**

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## Stage 2

✓An example for Stage 2 will be provided to you shortly.

✓Before starting **Stage 2**, you will participate in a practice year to get familiar with the experiment.

❗ Please note that your choices during the practice period **will not affect your payoff** in the experiment.

Please, raise your hand, if you have any questions.

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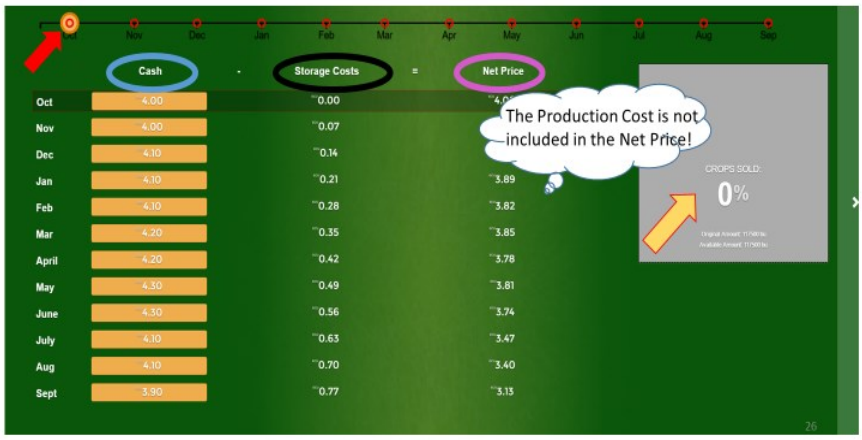
## Stage 2 Example-Price Table

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## Stage 2: Prices

- The computer changes the prices **from month to month.**
- The computer changes the prices **from year to year.**
- **The prices that you face in any month are not affected by your decisions in previous months and in previous years.**

❗ **Every time that you move to the next month you will face new prices for the remaining months. The computer decides these prices for you.**

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## Stage 2: Prices

- You have no control over prices. The computer decides the prices for you.
- Your decisions to sell grain do not affect the price you face in any month or in any year.

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## Stage 2 How to make a decision


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## Stage 2 How to make a decision_Transaction Box


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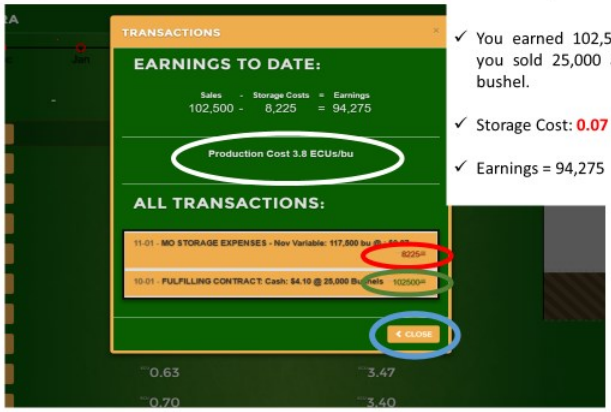
## Stage 2 How to make a decision


## Stage 2 Results Summary Table




- ✓ You earned 102,500 ECUs because you sold 25,000 at 4.10 ECUs per bushel.
- ✓ Storage Cost: **0.07 x 117,500 = 8,225**
- ✓ Earnings = 94,275

## Stage 2- Prices are different from month to month


## Stage 2- Quantity sold before the end of the year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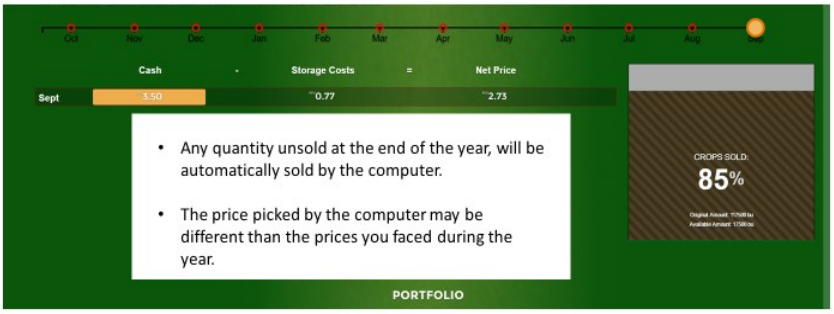
## Stage 2- Quantity unsold during the last period

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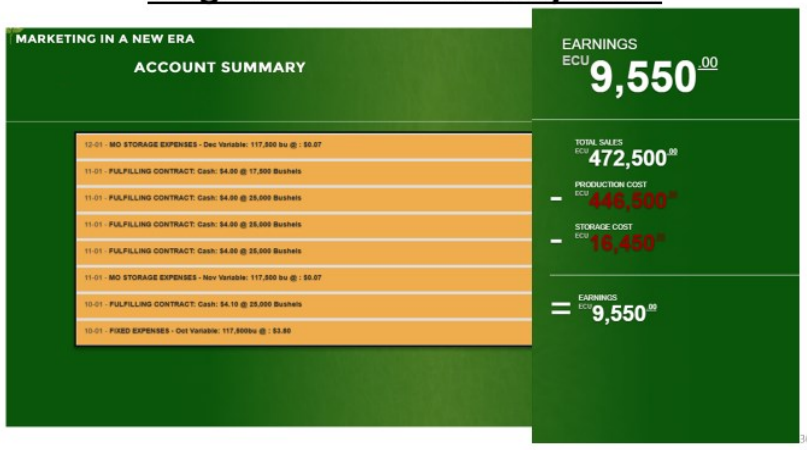
## Stage 2- Year's Summary Table

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## Stage 2- Earnings from the 4 years


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## Stage 2: Things to remember when selling your crop:

- ✓ You can only sell in units of 5,000 bushels, 10,000, 15,000, 20,000 or 25,000 bushels.
- ✓ You can make **more than one transactions in any month and for any month** if you want.
- ✓ If you are not satisfied with the prices you see for future months, you may skip making a transaction in that month.
- ✓ Please note that in this case, you will have to still pay the storage cost for any unsold amount for that month
- ✓ Once all 12 months of the year are over, you will move on to the next year where you will see a different set of prices and make decisions as before
- ✓ **Please note, that prices in different years are NOT related to each other. Also your choices in any year don't effect your earnings in any other years. So, your payoff in a year DOES NOT depend on your profit in past years.**

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## Payment

- ✓ Your payoff for **Stage 2** will be the sum of your earnings in ECUs for the four years.
- ✓ Your outcome from **Stage 1** will be added to your earnings from **Stage 2.**
- ✓ The sum of your earnings in Stage 1 and Stage 2 is your total amount of ECUs that will be converted to U.S. dollars.
- ✓ The money will be paid to you privately in cash after you have participated in a brief survey in **Stage 3** at the end of the experiment.

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## Stage 2-Practice Period

Now, you will participate in the **practice period** to better understand the experiment.

Please note that your choices in this practice period **will not affect your payoff** in the experiment.

**After completing the practice period, please proceed to Stage 2.**

Please, raise your hand, if you have any questions.

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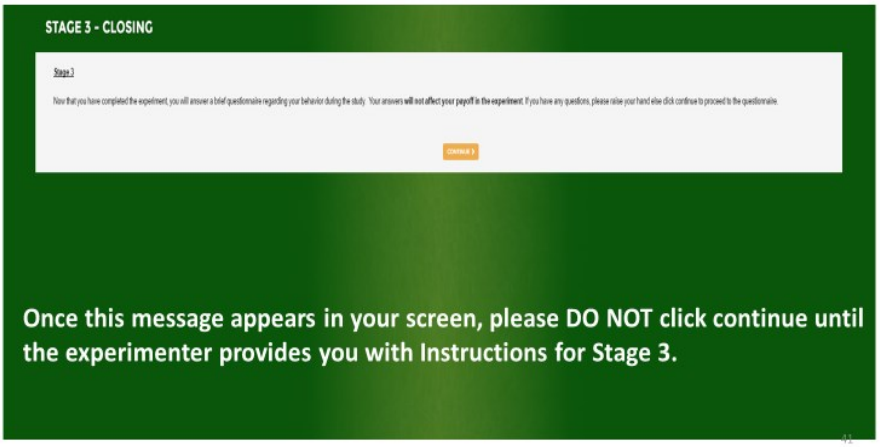
## Stage 2- End

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## Stage 3-Survey

- In Stage 3, you will answer a brief survey that will appear on the computer screen.
- Your answers to questions in the survey **will not affect your payoff in the experiment** and they **do not earn you any money.**
- Determination of payment in Stage 1.
- If you have any questions, please raise your hand else click continue to proceed to the survey.

# Appendix II: Socio-Demographic Survey

**Please provide an answer to the following general knowledge questions:**

**3.1.1.** There are 5 marbles in a bag: 4 are blue, and 1 is red. What is the probability that a blue marble gets picked?

3.1.2. Are you familiar with the concept of expected value? Please circle an answer:

Yes
No

3.1.3. What is the expected value for the following gamble? You can receive $10 with a probability of 1/3 and $20 with a probability of 2/3. Write down the answer in the space provided below.

---

**Please provide an answer in the following questions about the experiment:**

3.2.1. Is this the first economic experiment in which you have participated? Please circle an answer:

Yes
No
If No, approximately how many other experiments have you been in?
……..

3.2.2. Were the instructions for this experiment clear? Please circle an answer:

Yes
No
If No, what part was not clear?
……
……

3.2.3. Do you have any comments about the experiment? For example, you can comment on (i) what features of the experiment were driving your choices, (ii) your experience from today's experiment and any improvements that you think that are necessary. Please write them down in the space provided.

| |
|---|
| |

**Please provide an answer to the following demographic questions:**

3.3.1. What year are you in school?

Freshman
Sophomore
Junior
Senior
Other
If other, please specify:

3.3.2. Where do you study?

University of Nebraska-Lincoln
Nebraska College of Technical Agriculture in Curtis

What is your intended or declared major?
……
…….

3.3.3. Age:_____

3.3.4. Sex:

Male
Female
Don't wish to disclose

3.3.5. Nationality: U.S.A./ NOT U.S.A.

3.3.6. Are you part of any club or team?

Yes

No
Other
If other, please provide a brief explanation:
……
……

3.3.7. Have you ever been a farmer? Please circle the right answer:

Yes
No
Other
If other, please provide a brief explanation:
……
……

3.3.8. Is someone in your family a farmer?

Yes

No
Other
If other, please provide a brief explanation:
……
……

3.3.9. How familiar are you with commodity prices and commodity trading issues

1) Not at all familiar
2) Slightly familiar
3) Somewhat familiar
4) Moderately familiar
5) Extremely familiar